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FRIDAY, DECEMBER 30, 1977
PART XI

DEPARTMENT OF ENERGY

Energy Regulatory Administration

■

COOKING APPLIANCES

Energy Conservation Program

[3128-01]

DEPARTMENT OF ENERGY

Economic Regulatory Administration

[10 CFR Part 430]

ENERGY CONSERVATION PROGRAM FOR APPLIANCES

Proposed Rulemaking and Public Hearing Regarding Test Procedures for Conventional Ranges, Conventional Cooking Tops, Conventional Ovens, Microwave Ovens and Microwave/Conventional Ranges and Determination of Further Delay in the Publication of Proposed Test Procedures for Any Other Class of Kitchen Ranges and Ovens

AGENCY: Department of Energy.

ACTION: Proposed rule.

SUMMARY: The Department of Energy (DOE) hereby proposes to amend its regulations in order to prescribe test procedures for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges under the Energy Policy and Conservation Act (Act), and withdraws the Federal Energy Administration's (FEA) earlier proposed rulemaking concerning test procedures for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens. Conventional ranges, conventional cooking tops, conventional ovens, microwave ovens and microwave/conventional ranges are classes included within the broader type of appliances, kitchen ranges and ovens, covered by the Act. The Act requires that standard methods for testing covered appliance types be prescribed as part of the energy conservation program for appliances. The Act further authorizes DOE to prescribe test procedures for classes within a given type of covered product and permits DOE to delay the publication of proposed test procedures for some class or classes within a given type. DOE has determined to delay the publication of proposed test procedures for any class of the type of covered product designated by the Act as "kitchen ranges and ovens" other than conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges. The intended effect of this proposal is to implement the Act's requirements for the solicitation of public comments before test procedures are prescribed and to give notice of DOE's determination to delay the publication of certain proposed test procedures.

DATES: Comments by February 14, 1978; requests to speak by February 8, 1978; statements by February 13, 1978; hearing to be held on February 16, 1978 at 9:30 a.m.

ADDRESSES: Comments and requests to speak at the hearing to: Executive Communications, Room 3317, Department of Energy, Box QK, Washington, D.C. 20461; statements to Regulations Management, Room 2214, Department of Energy, 2000 M Street NW., Washington, D.C. 20461. Hearing held at: Room 2105, 2000 M Street NW., Washington, D.C. 20461.

FOR FURTHER INFORMATION CONTACT:

James A. Smith, (Office of Conservation and Solar Applications), Old Post Office Building, Room 307, 12th Street and Pennsylvania Avenue NW., Washington, D.C. 20461, 202-566-4635.

Robert C. Gillette, (Hearing Procedures), 2000 M Street NW., Room 222A, Washington, D.C. 20461, 202-254-5201.

Jim Merna, (Media Relations), 12th and Pennsylvania Avenue NW., Room 3104, Washington, D.C. 20461, 202-566-9833.

Michael T. Skinker, (Office of the General Counsel), 12th and Pennsylvania Avenue NW., Room 7148, Washington, D.C. 20461, 202-566-9750.

SUPPLEMENTARY INFORMATION:

A. Background

On October 1, 1977, the Department of Energy (DOE) assumed the Federal Energy Administration's (FEA's) authority under the Energy Policy and Conservation Act (Act) (Pub. L. 94-163), with regard to the energy conservation program for appliances, pursuant to section 301 of the Department of Energy Organization Act (DOE Act) (Pub. L. 95-91).

Test procedures for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens were previously proposed by FEA by notice issued June 9, 1977 (42 FR 30627, June 16, 1977), which solicited oral and written comments from interested persons. A public hearing on those proposed test procedures was held on August 11, 1977. A notice correcting a number of provisions contained in those test procedures was issued July 1, 1977 (42 FR 35170, July 8, 1977). After considering the comments received on FEA's proposed regulation of June 9, 1977 and further evaluation of those proposed test procedures, DOE has decided that certain changes are required. In particular, DOE has concluded that the method of determining the different useful measures of energy consumption provided in those proposed test procedures should be modified and that test procedures should be provided for the "microwave/conventional range" class of "kitchen ranges and ovens." Because the changes are so significant as to warrant reproposal, DOE today withdraws all aspects of the rulemaking concerning test procedures for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens previously proposed by FEA.

By this notice, DOE proposes to amend Chapter II of Title 10, Code of Federal Regulations, in order to prescribe test procedures for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges pursuant to section 323, 42 U.S.C. 6293, of the Act. The Act requires that DOE prescribe standard methods for testing covered appliances and further authorizes DOE to prescribe test procedures for classes within a given type of covered product. Conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges are classes included within the type designated by the Act as "kitchen ranges and ovens."

The adoption of test procedures, however, does not mean that actual testing must be completed. The procedures merely establish standard methods for testing when testing is otherwise required by the Act itself or by regulations implementing other parts of the program. For example, the Federal Trade Commission (FTC) may prescribe rules, pursuant to its labeling authority under the appliance program, which require that the test procedures be applied. It is contemplated by the Act that the test procedures will provide different measures of energy consumption which will be useful to consumers in making purchasing decisions when the measures are required by the FTC to be placed on the labels for the different appliances.

The Act also requires DOE to direct the National Bureau of Standards (NBS) to develop, for specifically named types of covered products, test procedures for the determination of the estimated annual operating cost and at least one other useful measure of energy consumption which DOE determines is likely to assist consumers in making purchasing decisions. Pursuant to the Act, DOE directed NBS to develop test procedures for DOE's use in prescribing test procedures under the Act. As part of this undertaking, NBS evaluated existing test procedures for measuring energy consumption of kitchen ranges and ovens.

NBS transmitted to DOE a test procedure review document which recommended test procedures for determining measures of energy consumption for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens which are classes of the broader appliance type designated by the Act as "kitchen ranges and ovens." In developing these test procedures, NBS consulted with the technical committees of the Association of Home Appliance Manufacturers (AHAM), the American Gas Association Laboratories (AGA Labs), and the Gas Appliance Manufacturers Association (GAMA). NBS also recommended that proposed test procedures for any other class of the type "kitchen ranges and ovens" be delayed until sufficient data are available. Copies of this review document will be made available for inspection by interested persons as provided for later in this notice.

The test procedures proposed by DOE today are based in large part on discussions with, recommendations of, and laboratory data derived by, NBS. They incorporate the field survey data and the general approach of the proposed AHAM Standard Test Method for Measuring Energy Consumption of Electric and Gas Ovens and Surface Units and Microwave

Ovens (ER–5–EC) dated August 2, 1976 and of the proposed AHAM Standard Performance Evaluation Procedure for Microwave Cooking Appliances (ER–4–MWO). They also incorporate the general approach contained in the American National Standards Institute (ANSI) standard ANS–C71.1–1972 for household electric ranges. Some provisions for conventional ranges, conventional cooking tops and conventional ovens contained in the ANSI standard ANS–Z21.1b–1976 for household cooking gas appliances and the Underwriters Laboratories Incorporated (UL) standard UL–858 for household electric ranges were also incorporated. Copies of this material will be made available for inspection by interested persons as provided for later in this notice.

Pursuant to section 301 of the DOE Act, DOE became responsible for complying with section 32 of the Federal Energy Administration Act of 1974 (FEA Act) (15 U.S.C. 761 et seq.), as amended by section 9 of the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95–70).

Sections 32 (a) and (b) of the FEA Act provide that:

(a) If any proposed rule by the Administrator contains any commercial standards, or specifically authorizes or requires the use of any such standards, then any general notice of the proposed rulemaking shall:

(1) Identify, by name, the organization which promulgated such standards; and

(2) State whether or not, in the judgment of the Administrator, such organization complied with the requirements of subsection (b) in the promulgation of such standards.

(b) An organization complies with the requirements of this subsection in promulgating any commercial standards if:

(1) It gives interested persons adequate notice of the proposed promulgation of the standards and an opportunity to participate in the promulgation process through the presentation of their views in hearings or meetings which are open to the public;

(2) The membership of the organization at the time of the promulgation of the standards is sufficiently balanced so as to allow for the effective representation of all interested persons;

(3) Before promulgating such standards, it makes available to the public any records of proceedings of the organization, and any documents, letters, memorandums, and materials, relating to such standards and

(4) It has procedures allowing interested persons to:

(A) Obtain a reconsideration of any action taken by the organization relating to the promulgation of such standards, and

(B) Obtain a review of the standards (including a review of the basis or adequacy of such standards).

The findings required of DOE by section 32 of the FEA Act serve to alert the public and DOE to the use and background of commercial standards in a proposed rulemaking and, through the comment and hearing process, allow interested persons to make known their views regarding the appropriateness of the use of those particular commercial standards in that proposed rulemaking. Any negative finding does not reflect a determination by DOE of any illegality, culpability, or liability on the part of the non-governmental organizations named.

As noted above, the rulemaking proposed today contains elements of three commercial standards promulgated by two non-governmental organizations, ANSI and UL. Both ANSI and UL were accorded an opportunity to submit relevant information to facilitate the required findings process.

DOE has made the following determinations regarding UL with respect to standard UL–858:

1. With regard to subsection 32(b)(1), DOE has determined UL did not provide interested persons adequate notice of the proposed promulgation. It did give interested persons an opportunity to participate in the promulgation process through the presentation of their views in meetings open to the public.

2. With regard to subsection 32(b)(2), DOE has determined UL did not have a membership sufficiently balanced so as to allow effective representation of all interested persons since it excluded from membership manufacturers of the products for which it set safety standards.

3. With regard to subsection 32(b)(3), DOE has determined UL did make available to the public any records of proceedings of the organization and material relating to its standards prior to the promulgation of its standards.

4. With regard to subsection 32(b)(4) DOE has determined that UL did have procedures allowing interested persons to obtain a reconsideration of any action by the organization pertaining to the promulgation of commercial standards, and to obtain a review of the standards, including a review of their basis and adequacy.

DOE has made the following determinations regarding ANSI with respect to standards ANS–Z21.1b–1976 and ANS–C.71.1–1972:

1. With regard to subsection 32(b)(1), DOE has determined that ANSI did provide interested persons adequate notice of the proposed promulgation of commercial standards and an opportunity to participate, in the committee promulgation process, through the presentation of their views at meetings open to the public.

2. With regard to subsection 32(b)(2), DOE has found that for the specific subsections of ANS–Z.21.1b–1976 and ANS–C.71.1–1972 employed in this proposed rulemaking, the membership of ANSI was sufficiently balanced so as to allow for the effective representation of all persons interested in those subsections. (DOE does not hereby make a determination regarding the balance of ANSI's membership with respect to the subsections of these standards which are not relevant to this proposed rule. For purposes of this proposed rule, DOE considers the requirements of section 32(b)(2) met where the balance of the membership of the organization is reviewed with respect to the particular sections of a standard actually employed in the proposed rule.)

3. With regard to subsection 32(b)(3), DOE has determined that ANSI does, prior to the promulgation of commercial standards make available to the public any records and materials relating to such standards.

4. With regard to subsection 32(b)(4), DOE has determined that ANSI does have procedures allowing interested persons to obtain a reconsideration of any action taken by the organization relating to the promulgation of such standards and a review of the standards, including a review of the basis or adequacy of such standards.

Information regarding the basis for the determinations made above is available for inspection by interested persons as provided for later in this notice. DOE notes that portions of the above mentioned standards were employed in this proposed rulemaking following the recommendation of NBS that these standards provided a sound method of accomplishing the purposes for which they were used.

In addition to the organizations noted earlier, this proposed rulemaking incorporates elements of two draft AHAM standards. DOE notes that these draft standards have not yet been promulgated. DOE has, therefore, not made section 32(b) findings with respect to these draft standards because that section requires such findings only in the case of promulgated standards.

In this proposed rulemaking, DOE is providing interested persons an opportunity to comment on the appropriateness of the elements of these standards which are proposed for use in the test procedures. Comments are specifically requested on any specific changes the commenter believes are necessary to make the standards appropriate for the purposes of testing conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ovens.

DOE is today withdrawing the previously proposed definitions in section 430.2 of "surface unit," "electric range," and "non-electric range." DOE is today proposing the amendment of Section 430.2 by inserting a definition of "surface unit" and by adding new definitions of "kitchen ranges and ovens" and of each of the different classes of the type "kitchen ranges and ovens." DOE is also proposing to amend section 430.2 by adding a definition of the term "basic model" for kitchen ranges and ovens by adding a subparagraph (9) of that section. Definitions of the terms "DOE" and "Secretary" have also been proposed for addition to Subpart A for the purpose of clarification. Comments on these definitions are timely as provided below.

B. Outline of Part 430

By notice issued May 24, 1977 (42 FR 27896, June 1, 1977), FEA established Subparts A and B of Part 430, Chapter II of Title 10, Code of Federal Regulations. Certain definitions and general provisions applicable to the energy conservation program for appliances have been promulgated in Subpart A. Final test procedures for room air conditioners, dishwashers, clothes dryers, water heaters, television sets, electric-refrigerators, electric refrigerator-freezers, clothes washers, humidifiers, dehumidifiers, and central air conditioners have been prescribed in Subpart B. Other test procedures have been proposed for inclusion in Subpart B. By this rulemaking, DOE is proposing test procedures for conventional ranges, conventional cooking tops, conventional ovens, and microwave/conventional ranges, and is including a determination to delay the publi-

cation of test procedures for any other class of the type "kitchen ranges and ovens." FEA also proposed a Subpart C for appliance energy efficiency improvement targets. An outline of the provisions of Subparts A and B of Part 430 which have so far been established is as follows:

SUBPART A—GENERAL PROVISIONS

Sec.
430.1 Purpose and Scope.
430.2 Definitions.

SUBPART B—TEST PROCEDURES

430.21 Purpose and Scope.
430.22 Test Procedures for Measures of Energy Consumption:
(a) Refrigerators and refrigerator-freezers.
(b) Freezers.
(c) Dishwashers.
(d) Clothes dryers.
(e) Water heaters.
(f) Room air conditioners.
* * * * *
(h) Television sets.
* * * * *
(j) Clothes Washers.
(k) Humidifiers.
(l) Dehumidifiers.
(m) Central air conditioners.
430.23 Units to be Tested [Reserved].
430.24 Representations Regarding Measures of Energy Consumption:
(a) Refrigerators and refrigerator-freezers.
(b) Freezers.
(c) Dishwashers.
(d) Clothes dryers.
(e) Water heaters.
(f) Room air conditioners.
* * * * *
(h) Television sets.
* * * * *
(j) Clothes washers.
(k) Humidifiers.
(l) Dehumidifiers.
(m) Central air conditioners.

APPENDICES TO SUBPART B

Appendix A1—Uniform Test Method for Measuring the Energy Consumption of Electric Refrigerators and Electric Refrigerator-Freezers.
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Appendix B—Uniform Test Method for Measuring the Energy Consumption of Freezers.
Appendix C—Uniform Test Method for Measuring the Energy Consumption of Dishwashers.
Appendix D—Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers.
Appendix E—Uniform Test Method for Measuring the Energy Consumption of Water Heaters.
Appendix F—Uniform Test Method for Measuring the Energy Consumption of Room Air Conditioners.
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Appendix H—Uniform Test Method for Measuring the Energy Consumption of Television Sets.
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Appendix J—Uniform Test Method for Measuring the Energy Consumption of Clothes Washers.
Appendix K1—Uniform Test Method for Measuring the Energy Consumption of Central System Humidifiers.
Appendix K2—Uniform Test Method for Measuring the Energy Consumption of Room Humidifiers.
Appendix L—Uniform Test Method for Measuring the Energy Consumption of Dehumidifiers.
Appendix M—Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners.

C. MEASURES OF ENERGY CONSUMPTION

The Act requires DOE to prescribe test procedures for the determination of estimated annual operating costs and at least one other useful measure of energy consumption which the Secretary determines is likely to assist consumers in making purchasing decisions.

DOE is proposing to establish estimated annual operating costs for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges (sections 430.22(i)(1)–(8)). In each case, the estimated annual operating cost will be the product of the total energy consumption for the representative average-use cycle of one year (annual energy consumption) times the cost of the energy (representative average unit costs as provided pursuant to section 323(b)(2) of the Act). For each appliance which uses both gas and electrical energy, the estimated annual operating cost for that appliance is determined by separately calculating the estimated annual operating cost for each source of energy and then adding the costs together.

The total annual energy consumption for a conventional range is the sum of the annual energy consumption of the conventional cooking top plus the annual energy consumption of any conventional ovens.

The total annual energy consumption of a conventional cooking top is the sum of the annual energy consumption of any continuously burning gas pilot lights (4.2.2.2 of Appendix I) plus the annual cooking energy consumption of the conventional cooking top. The annual cooking energy consumption is determined from the quotient of the annual useful cooking energy output of the conventional cooking top, as determined from the AHAM field and laboratory study, divided by the cooking efficiency of the conventional cooking top (4.2.1 of Appendix I).

The total annual energy consumption of a conventional oven is the sum of the annual energy consumption of the self-cleaning operation of the conventional oven, plus the annual energy consumption of any clocks, plus the annual energy consumption of any continuously burning pilot lights, plus the annual cooking energy consumption of the conventional oven. The annual cooking energy consumption of the conventional oven is determined from the annual useful cooking energy output for the conventional oven and the conventional oven test data (4.1.2.1 of Appendix I). If the oven can be operated in more than one baking mode, such as with or without forced convection, the determination of the annual cooking energy consumption of the oven utilizes the average test energy consumption of the oven (4.1.1.3 of Appendix I), as tested in all modes of operation. Also, if the basic model tested has more than one conventional oven, the annual cooking energy consumption of the ovens of that basic model is the average of the sum of the cooking energy consumptions for each of the ovens. The annual energy consumption of the self-cleaning operation of a conventional oven is the product of the energy consumption of the self-cleaning operation (3.2.1.1 of Appendix I) times 11 for electric ovens and 7 for gas ovens. These figures represent the average number of times the self-cleaning operation of the different types of conventional ovens is used per year. The representative average number of times the self-cleaning operation of a conventional oven is used per year is based on NBS' recommendation to DOE.

The annual energy consumption of any continuously burning pilot lights of a conventional gas oven is the energy consumed hourly by the pilot lights times 8,460 hours per year. The continuously burning pilot lights are consuming energy each hour of the year (there are 8,760 hours in a year). NBS has determined that 300 hours of the energy consumed by any of the oven's pilot lights contributes to the energy consumed by the conventional gas oven when the oven is being used for heating food. Therefore, the energy consumed by the continuously burning lights per hour is multiplied by 8,460 rather than 8,760 hours to arrive at the annual energy consumption for the pilot lights.

The annual energy consumption of a microwave oven is the sum of the annual energy consumption of any features of the oven which use energy when the microwave oven is turned off plus the quotient of the annual useful cooking energy output divided by the oven's cooking efficiency (4.4.4. of Appendix I).

The annual energy consumption of a microwave/conventional range is the sum of the annual energy consumption of the conventional oven, the microwave oven, and the conventional cooking top that comprise the basic model of the microwave/conventional range. The total annual energy consumption of each of these components is determined as previously described in this preamble; except with respect to the determination of the annual cooking energy consumptions of the conventional oven and the conventional cooking top discussed below.

There is little actual field data on the usage of a conventional cooking top and a conventional oven in combination with a microwave oven. The AHAM field survey, however, indicated that a microwave oven was used more to replace usage of a cooking top than of a conven-

tional oven. Therefore, for the purpose of estimating the annual energy consumption of microwave/conventional ranges, DOE has assumed that 75 percent of the microwave oven usage has been to replace the cooking top usage and the remaining 25 percent has been to replace the conventional oven usage. It has also been assumed that the annual useful cooking energy output of the microwave oven portion of the microwave/conventional range is the same as that of a counter-top microwave oven, 34.2 kwh per year; and that the total useful cooking energy output of the microwave/conventional range is the same as that of a conventional range, 324.8 kwh per year. The industry and other interested persons are encouraged to provide any reliable data to DOE as it becomes available concerning the actual usage by consumers of microwave/conventional ranges.

The annual useful cooking energy outputs of conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens, and microwave/conventional ranges were determined from field survey data obtained by NBS from AHAM. In the AHAM survey, these appliances were monitored during actual home use to determine the total energy consumed. The annual useful cooking energy output figures for these appliances represent the energy actually absorbed by the food for cooking and were computed by multiplying the appliance's cooking efficiency times its annual cooking energy consumption. The annual cooking energy consumption of a conventional oven was determined by subtracting the estimated annual energy consumption of the self-cleaning operation and the electric clock from the field data for the total annual energy consumption of the conventional oven. Also, all modes of cooking on each accounted (e.g., broiler of an oven, griddle of a cooking top) were potentially accounted for by the energy consumption data from the AHAM survey. The appliances were then tested by laboratory methodology very similar to that proposed today to determine their cooking efficiency. While the annual energy consumption figures generated by the survey potentially included all modes of cooking, the laboratory methodology used to determine the cooking efficiency of the appliance measures only the energy consumed when the appliance is operated as it would primarily be used by consumers (e.g., baking in an oven). NBS has determined that the uniform test method for measuring the energy consumption of conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges provides data that are representative of actual consumer use in the home.

The annual useful cooking energy output figures proposed in these test procedures are: 324.8 kilowatt-hours per year (1,109,000 Btu's per year) for conventional ranges and for microwave/conventional ranges, 277.7 kilowatt-hours per year (948,000 Btu's per year) for conventional cooking tops; 47.09 kilowatt-hours per year (160,700 Btu's per year) for conventional ovens; and 34.2 kilowatt-hours per year for microwave ovens. Copies of the AHAM field survey data may be obtained for review by interested persons as provided for later in this notice.

Two additional proposed measures (section 430.22(i) (9) and (10)) that are likely to assist consumers in making purchasing decisions are the cooking efficiency and the energy factor.

For all conventional ovens the cooking efficiency is the quotient of the annual useful cooking energy output divided by the annual cooking energy consumption (4.1.3 of Appendix I).

For all conventional cooking tops the cooking efficiency is the arithmetic average of the cooking efficiencies of its individual heating elements. The cooking efficiency of a heating element is the quotient of the energy absorbed by the test block divided by the energy input to the heating element during the test (4.2.1 of Appendix I).

The cooking efficiency for conventional ranges and microwave/conventional ranges (4.3.2 and 4.5.2 respectively of Appendix I) is defined as the quotient of the annual useful cooking energy output divided by the annual cooking energy consumption for the range under test.

For microwave ovens, the cooking efficiency is defined as the average of the sum of the microwave oven's cooking efficiencies for the four-test loads (4.4.3 of Appendix I). The microwave oven's cooking efficiency for a specific test load is defined as the quotient of the product of the average microwave power output, expressed in watts, times the elapsed test time in seconds, divided by the product of the energy consumed during the test in watt-hours times 3,600 seconds per hour (4.4.2 of Appendix I).

For conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges the energy factor is defined as the ratio of the annual useful cooking energy output of the appliance to its total annual energy consumption.

DOE recognizes that there may be additional useful measures of energy consumption for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges other than the measures described above. Accordingly, today's proposal, in proposed subparagraph 430.22(i)(11), provides for other useful measures which the Secretary determines are likely to assist consumers in making purchasing decisions. These measures, however, must be derived from the application of the uniform test method proposed today as Appendix I to Subpart B. Manufacturers would, if required, only have to perform various computations while still applying the same test method contained in Appendix I. For example, if the Secretary determined that a per-day energy cost would aid consumers in making purchasing decisions, this cost could be derived by applying the uniform test procedures to calculate the estimated annual operating cost and then dividing by 365 days per year to achieve a per-day cost figure.

D. Laboratory Methodology

Proposed Appendix I to Subpart B provides for a controlled laboratory environment for measuring energy consumption for the various conventional ranges, conventional cooking tops, conventional ovens, microwave ovens and microwave/conventional ranges which are available to the consumer. The proposed test procedures apply to appliances which may contain energy consuming cooking features and devices which are not accounted for in the laboratory test measurements. Such cooking features may include broilers, griddles, grills or deep-well cookers. Such devices may include automatic temperature controlled surface units, keep-warm timers or other energy consuming devices. The effect these cooking features or devices may have on the annual energy consumption of the appliance in actual use by the consumer cannot be quantified due to the lack of data on the separate energy consumption, energy efficiency, and consumer usage of these cooking features or devices. NBS, however, has determined that the proposed test procedures produce results in the laboratory which are representative of the energy that would be consumed annually by that appliance in the home. DOE specifically requests comments and data from manufacturers and other interested persons regarding the energy consumption, cooking efficiency, energy factor and consumer usage patterns on any such cooking features or devices.

A conventional oven cooks food by heating a compartment into which the food has been placed. The food is cooked by absorbing the heat in the compartment. In the proposed test procedures for conventional ovens, an anodized aluminum alloy block is used as the standard test load. A metal block is used because it provides a standard, uniform, and repeatable means of testing the oven and reduces the variability that might occur if other loads were used. The proposed test procedures require that the temperature of the test block be raised 234° above its initial temperature. The proposed temperature rise and block specifications are based on tests and studies done by the industry and NBS which indicate that these conditions simulate, in a controlled laboratory environment, the actual average use of the conventional oven in the home. Copies of these data may be obtained for review by interested persons, as provided for later in this notice.

For conventional cooking tops a metal block is again used as the standard test load. For electric heating elements two different sized test blocks are used depending on the size of the heating element. The larger of these test blocks is used to test all gas heating elements. The difference in the size and the weight of the test blocks are proposed because they are the standard measures used in the

proposed AHAM standard ER–5EC and provide repeatable and accurate test results.

The proposed test procedures for conventional cooking tops provide that the standard test block be raised 144°F above its initial temperature (3.1.2 of Appendix I); the energy input to the gas or electric heating element is then decreased by reducing the energy input rate from its maximum value to 25 percent of its maximum value for 15 minutes in order to represent actual use conditions in the home. The proposed specified loads and temperature control procedures are based on NBS' recommendation which, in turn, is based on industry studies. Copies of these documents will be made available for inspection by interested persons, as provided for later in this notice.

A microwave oven heats by the transmission of electromagnetic waves (microwave energy) to the food rather than by conduction. The energy is absorbed by the food and converted to heat. The proposed microwave oven test procedure uses glass beakers filled with different quantities of distilled water containing one percent sodium chloride (NaCl) as the standard test loads. Glass beakers filled with the salt water solution are used because the glass transmits the microwave energy and the saline solution absorbs the microwave energy in the same manner as food does. Metal blocks would not be appropriate for the test load since metal reflects microwave energy. Specified quantities of the saline solution are proposed as the test loads, rather than food, in order to provide repeatable, accurate and uniform test results. Test loads of 275, 500, 1,000, and 2,000 milliliter water loads raised 45±9° F above their initial temperature are proposed in order to determine the microwave oven's average power output. Based on discussions with the industry, NBS has determined that the proposed microwave oven test loads and temperature rise provide a representative simulation in the laboratory of the actual use of microwave ovens in the home.

Section 323(a)(3) of the Act requires that proposed test procedures for kitchen ranges and ovens be published not later than September 30, 1976. Section 323(a)(6) of the Act, however, provides that the publication of proposed test procedures for a type of covered product (or class thereof) may be delayed beyond the required dates of publication if it is determined that publication of the proposed test procedures cannot be made within the applicable time period and notice of such determination is published in the FEDERAL REGISTER. On October 21, 1976, FEA issued a notice including its determination of the necessity to delay the publication of proposed test procedures for kitchen ranges and ovens (41 FR 47286, October 28, 1976).

In addition to proposing test procedures for most classes of "kitchen ranges and ovens" today, DOE hereby gives notice of its determination to delay further the publication of proposed test procedures for any class of the type "kitchen ranges and ovens" other than conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges. In particular, DOE intends to delay further the publication of proposed test procedures for the following two consumer products which are relatively new products and, therefore, presently represent only a small percentage of the market: (1) cooking tops which utilize induction surface heating elements; (2) single compartment ovens which are capable of heating food by means of electric resistance heaters and microwave energy in the same compartment. NBS has determined that there is not sufficient data on the consumer usage of these products to develop adequate test procedures to measure their energy consumption, cooking efficiency, or energy factor. DOE will publish proposed test procedures for such products, as soon as practicable, unless it determines that test procedures cannot be developed which meet the requirements of section 323(b) of the Act and publishes such determination in the FEDERAL REGISTER, together with the reasons therefor.

E. REPRESENTATIVE AVERAGE-USE CYCLE

Section 323(b)(2) (42 U.S.C. 6293(b)(2)) of the Act provides that test procedures for determining estimated annual operating costs of any covered product shall be calculated from measurements of energy use in a representative average-use cycle (provided pursuant to section 323(b)(1) of the Act) and from representative average unit costs (provided pursuant to section 323(b)(2) of the Act) needed to operate such product during such cycle. DOE has determined that the representative average-use cycle for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges is one year. This determination is based upon NBS' recommendation to DOE which, in turn, is based upon the premise that a cycle representing a year's usage will encompass variations such as seasonal patterns, and the effects of vacations and holidays. NBS' recommendation is available for inspection, as provided for later in this notice.

F. UNIT COSTS OF ENERGY

Under section 323(b)(2) of the Act, FEA was to provide manufacturers with information on representative average unit costs of energy. This information was provided by notice issued July 11, 1977 (42 FR 36549, July 15, 1977).

NUMBER OF UNITS TO BE TESTED

Test procedures prescribed under section 323 of the Act are intended ultimately to be used, for example, for labeling under section 324, for monitoring the progress of manufacturers toward accomplishing the energy efficiency improvement targets under section 325, and for enforcement testing under section 326. Those aspects of the appliance program have not, however, been implemented. It is quite possible that the objectives of appliance testing under each of these parts of the program, as well as the instructions on how a test procedure should be applied (e.g., sampling of production units), may differ. DOE, NBS, and FTC are continuing to evaluate the appropriate method or methods for applying the test procedures in order to comply with the statute and satisfy all of the different elements of the appliance program. Thus, proposal of a generalized test methodology for applying test procedures is inappropriate at this time.

While the various parts of the appliance program identified above are not in effect at this time, section 323(c) of the Act provides:

> Effective 90 days after a test procedure rule applicable to a covered product is prescribed under this section, no manufacturer, distributor, retailer, or private labeler may make any representation—
>
> (1) In writing (including a representation on a label), or
>
> (2) In any broadcast advertisement, respecting the energy consumption of such product or cost of energy consumed by such product, unless such product has been tested in accordance with such test procedure and such representation fairly discloses the results of such testing.

In order to implement this statutory requirement, the sampling requirements proposed today have been organized into section 430.24(i) and apply only where a representation is made with respect to the energy consumption of kitchen ranges and ovens.

Proposed section 430.24(i) would provide a method by which the minimum size of a sample of kitchen ranges and ovens would be determined. Representations regarding the energy consumption of kitchen ranges and ovens would be based upon the testing of that sample. Under the proposed regulations, the sample would have to be of sufficient size to assure that, for each representation regarding a measure of energy consumption described in section 430.22(i), there is a 95-percent confidence that the true mean of such measures of the basic model to which the representation applies is within 5 percent of the mean of such measures of the sample.

Strict sampling of conventional and microwave/conventional ranges could, in many cases, result in duplicative testing. This is because it is likely that the conventional cooking tops, conventional ovens, and microwave ovens which comprise these products would be marketed as distinct products and would, therefore, have already been tested. In order to avoid re-testing the components of conventional and microwave/conventional ranges, section 430.24(i) would permit data obtained from the testing of cooking tops, conventional ovens, and microwave ovens which comprise conventional ranges and microwave/conventional ranges to be used in making representations concerning those ranges.

Manufacturers and other interested persons are encouraged to comment on the sampling approach. Manufacturers are especially encouraged to submit any data which relates to the size of the

samples which the provision would require to be tested. Comments alleging that the sampling provision is burdensome or otherwise inappropriate should include a full discussion of the facts upon which such allegation is based and, preferably, an alternate proposal.

H. Request for Particular Comments

While DOE is soliciting comments on all aspects of the proposed test procedures, DOE is particularly interested in receiving comments on any other useful measures of energy consumption for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges in addition to those proposed today. DOE is also requesting that it be provided with any available data on typical consumer usage of conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges.

In addition, DOE is interested in receiving comments on any definitions already promulgated or proposed in section 430.2, as discussed above, as these provisions might affect the testing of conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges. Comments with respect to these definitions are timely until the close of the written record, as specified below.

I. Comment Procedure

1. General

Any persons who previously submitted written or oral comments with respect to the kitchen ranges and ovens proposed test procedures issued by FEA on June 9, 1977 (42 FR 30627, June 16, 1977) should review those comments in order to determine if they would be applicable to today's proposal. Those persons are encouraged to resubmit all applicable comments, since the final rulemaking regarding these test procedures will be based solely upon today's proposal and any oral or written comments received in response thereto.

Any oral or written comments to the proposed test procedures should include all available data which supports the view proffered by the commenter. Where the comment is critical of the proposed test procedures, alternatives should be provided, wherever possible.

2. Written comments

Interested persons are invited to participate in this rulemaking by submitting data, views, or arguments with respect to the proposed test procedures for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges set forth in this notice to Executive Communications, Room 3317, Department of Energy, Box QK, Washington, D.C. 20461.

Comments should be identified on the outside of the envelope and on documents submitted to DOE with the designation "Kitchen Ranges and Ovens—Proposed Test Procedures." Fifteen copies should be submitted. All copies received by February 14, 1978, before 4:30 p.m., e.d.t., and all other relevant information, will be considered by DOE before final action is taken on the proposed regulations.

Any information or data considered by the person furnishing it to be confidential must be so identified and submitted in writing, one copy only. DOE reserves the right to determine the confidential status of the information or data and treat it according to its determination.

3. Public hearings

a. *Request procedures.* The time and place of the public hearing are indicated at the beginning of this preamble. The hearing will be continued, if necessary, on February 17, 1978.

DOE invites any person who has an interest in the proposed rulemaking issued today, or who is a representative of a group or class of persons that has an interest in today's proposed rulemaking, to make a written request for an opportunity to make an oral presentation. Such a request should be directed to the address indicated at the beginning of this preamble and must be received before 4:30 p.m., e.d.t., on February 8, 1978. Such a request may be hand delivered to such address, between the hours of 8 a.m. and 4:30 p.m., Monday through Friday. A request should be labeled both on the document and on the envelope "Kitchen Ranges and Ovens—Proposed Test Procedures."

The person making the request should briefly describe the interest concerned; if appropriate, state why she or he is a proper representative of a group or class of persons that has such an interest; and give a concise summary of the proposed oral presentation and a telephone number where she or he may be contacted through February 16, 1978.

DOE will notify, before 4:30 p.m., e.d.t., February 10, 1978, each person selected to appear at a hearing. Each person selected to be heard must submit 50 copies of her or his statement to the address and by the date given in the beginning of this preamble. In the event any person wishing to testify cannot meet the 50-copy requirement, alternative arrangements can be made with the Economic Regulatory Administration (ERA) in advance of the hearing by so indicating in the letter requesting an oral presentation or by calling the ERA at 202–254–3345.

b. *Conduct of hearings.* DOE reserves the right to select the persons to be heard at this hearing, to schedule their respective presentations and to establish the procedures governing the conduct of the hearing. The length of each presentation may be limited, based on the number of persons requesting to be heard.

A DOE official will be designated to preside at the hearing. This will not be a judicial or evidentiary-type hearing. Questions may be asked only by those conducting the hearing, and there will be no cross-examination of the persons presenting statements. Any decision made by DOE with respect to the subject matter of the hearing will be based on all information available to DOE. At the conclusion of all initial oral statements, each person who has made an oral statement will be given the opportunity if she or he so desires, to make a rebuttal statement. The rebuttal statements will be given in the order in which the initial statements were made and will be subject to time limitations.

Any interested person may submit questions to be asked of any person making a statement at the hearing to Executive Communications, DOE, before 4:30 p.m., e.d.t., February 14, 1978. DOE will determine whether the question is relevant, and whether the time limitations permit it to be presented for answer.

Any person who makes an oral statement and who wishes to ask a question at the hearing may submit the question, in writing, to the presiding officer. The presiding officer will determine whether the question is relevant, and whether the time limitations permit it to be presented for answer.

Any further procedural rules needed for the proper conduct of the hearing will be announced by the presiding officer.

A transcript of the hearing will be made and the entire record of the hearing, including the transcript, will be retained by DOE and made available for inspection at the DOE Freedom of Information Office, Room 2107, Federal Building, 12th and Pennsylvania Avenue NW., Washington, D.C., between the hours of 8 a.m. and 4:30 p.m., Monday through Friday. Any person may purchase a copy of the transcript from the reporter. A copy of NBS' recommendations concerning these test procedures, along with the ANSI standards ANS–Z21.1b–1976 and ANS–C71.1, the UL standard UL–858, the proposed AHAM Standard Performance Evaluation Procedure for Microwave Cooking Appliances (ER–4–MWO), and the proposed AHAM Standard Test Method for Measuring Energy Consumption of Electric and Gas Ovens and Surface Units and Microwave Ovens (ER–5–EC) dated August 2, 1976, will be made available for inspection at the DOE Freedom of Information Office. Information regarding the basis for DOE's determinations in this proposed rulemaking with respect to the private commercial standard-setting organizations will also be available at the DOE Freedom of Information Office.

J. Environmental and Inflationary Review

As required by section 7(c)(2) of the FEA Act, a copy of this notice has been submitted to the Administrator of the Environmental Protection Agency for his comments concerning impact of this proposal on the quality of the environment. The Administrator has no comments.

The National Environmental Policy Act of 1969 requires DOE to assess the environmental impacts of any proposal issued by the Department for "major Federal actions significantly affecting

the quality of the human environment." Since test procedures under the energy conservation program for appliances will be used only to standardize the measurement of energy usage and will not affect the quality or distribution of energy usage, DOE has determined that the action of prescribing test procedures, by itself, will not result in any environmental impacts. On this basis, DOE has determined that, with respect to prescribing test procedures under the energy conservation program for appliances, no environmental impact statement is required.

NOTE.—The proposed rule has been reviewed in accordance with Executive Order 11821 as amended by Executive Order 11949, and OMB Circular No. A-107 and has been determined not to be a major proposal requiring evaluation of its economic impact as provided for therein.

(Energy Policy and Conservation Act, Pub. L. 94-163, as amended by Pub. L. 94-385; Federal Energy Administration Act of 1974, Pub. L. 93-275, as amended by Pub. L. 94-385; Department of Energy Organization Act, Pub. L. 95-91; EO 11790, 39 FR 23185.)

In consideration of the foregoing, proposed amendments to Part 430 of chapter II of Title 10, Code of Federal Regulations, published in 42 FR 30627, June 16, 1977, are hereby withdrawn and it is proposed to amend Part 430 of Chapter II of Title 10, Code of Federal Regulations, as set forth below.

Issued in Washington, D.C., December 21, 1977.

WILLIAM S. HEFFELFINGER,
Director of Administration.

1. Section 430.2 is amended by adding paragraph (9) as part of the definition of "basic model," and by adding in the appropriate alphabetical order definitions of "conventional cooking top," "conventional oven," "conventional range," "DOE," "kitchen ranges and ovens," "microwave oven," "microwave/conventional range," "other kitchen ranges and ovens," "Secretary," and "surface unit" to read as follows:

§ 430.2 Definitions.

* * * * *

"Basic model" means all units of a given type of covered product (or class thereof) manufactured by one manufacturer and:

* * * * *

(9) With respect to kitchen ranges and ovens, which have the same primary energy source, which have electrical characteristics that are essentially identical, and which do not have any differing physical or functional characteristics that affect energy consumption.

* * * * *

"Conventional cooking top" means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a horizontal surface containing a surface unit or surface units which are heated by means of either gas burners or electric resistance heaters.

* * * * *

"Conventional oven" means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a compartment or compartments intended for the cooking or heating of food by means of either gas burners or electric resistance heaters. It does not include portable or countertop ovens which use electric resistance heaters for the cooking or heating of food and are designed for an electrical supply or approximately 120 volts.

* * * * *

"Conventional range" means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a conventional cooking top and one or more conventional ovens, in which either the cooking top or the oven (or ovens) utilize either gas burners or electric resistance heaters as the source of heat.

* * * * *

"DOE" means the Department of Energy.

* * * * *

"Kitchen ranges and ovens" means consumer products that are used as the major household cooking appliances. They are designed to cook or heat different types of food by one or more of the following sources of heat: gas, electricity, or microwave energy. Each product may consist of a horizontal cooking top containing a surface unit or surface units and/or one or more heating compartments. They must be one of the following classes: conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, microwave/conventional ranges, and other kitchen ranges and ovens.

* * * * *

"Microwave oven" means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a compartment designed to cook or heat food by means of microwave energy.

* * * * *

"Microwave/conventional range" means a class of kitchen ranges and ovens which is a household cooking appliance consisting of a microwave oven, a conventional oven, and a conventional cooking top.

* * * * *

"Other kitchen ranges and ovens" means any class of kitchen ranges and ovens other than the conventional range, conventional cooking top, conventional oven, microwave oven, and microwave/conventional range classes.

* * * * *

"Secretary" means the Secretary of Energy.

* * * * *

"Surface unit" means either a unit mounted in a cooking top or a heated area of a cooking top on which vessels are placed for the cooking or heating of food.

* * * * *

2. Section 430.22 is amended by adding a paragraph (i), to read as follows:

§ 430.22 Test procedures for measures of energy consumption.

* * * * *

(i) *Kitchen ranges and ovens.* (1) The estimated annual operating cost for conventional cooking tops shall be the product of the following two factors—(i) the total conventional cooking top annual energy consumption in kilowatt-hours (kWh's) per year for conventional electrical cooking tops and in British thermal units (Btu's) per year for conventional gas cooking tops, determined according to 4.2.2 of Appendix I to this subpart, and (ii) the representative average unit cost in dollars per kWh or Btu as provided pursuant to section 323(B)(2) of the Act, the resulting product then being rounded off to the nearest dollar per year.

(2) The estimated annual operating cost for conventional ovens which use only electrical energy or only gas energy shall be the product of the following two factors—(i) the total conventional oven annual energy consumption in kWh's per year for electrical energy and Btu's per year for gas energy, determined according to 4.1.2.5 or 4.1.2.6 of Appendix I to this subpart, and (ii) the representative average unit cost in dollars per kWh or Btu as provided pursuant to section 323(B)(2) of the Act, the resulting produot then being rounded off to the nearest dollar per year.

(3) For conventional ovens which use both gas and electrical energy the estimated annual operating cost shall be the sum of the estimated annual operating cost for each source of energy, as determined in paragraph (i)(2) of this section, and the resulting sum then being rounded off to the nearest dollar per year.

(4) The estimated annual operating cost for conventional ranges which use only electrical energy or only gas energy shall be the product of the following two factors—(i) the total conventional range annual energy consumption, in kWh's per year for electrical energy and Btu's per year for gas energy, determined according to 4.3.1 of Appendix I to this subpart, and (ii) the representative average unit cost in dollars per kWh or Btu as provided pursuant to section 323(B)(2) of the Act, the resulting product then being rounded off to the nearest dollar per year.

(5) For ranges which use both gas and electrical energy the estimated annual operating cost shall be the sum of the estimated annual operating cost for each source of energy, as determined in paragraph (i)(4) of this section, and the resulting sum then rounded off to the nearest dollar per year.

(6) The estimated annual operating cost for microwave ovens shall be the product of the following two factors—(i) the total microwave oven annual energy consumption in kWh's per year, determined according to 4.4.4 of Appendix I to this subpart, and (ii) the representative average unit cost in dollars per kWh as provided pursuant to section 323(B)(2) of the Act, the resulting product then being rounded off to the nearest dollar per year.

(7) The estimated annual operating cost for microwave/conventional ranges which use only electrical energy shall be the product of the following two factors—(i) the total annual energy consumption of the range in kWh's determined according to 4.5.1 of Appendix I to this subpart and (ii) the representative average unit cost in dollars per kWh as provided pursuant to section 323(B)(2) of the Act, the resulting product then being rounded off to the nearest dollar per year.

(8) For microwave/conventional ranges which use both gas and electrical energy the estimated annual operating cost shall be the sum of the estimated annual operating cost for each source of energy, as determined in paragraph (i)(7) of this section, and the resulting sum then rounded off to the nearest dollar per year.

(9) The cooking efficiency for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges shall be the ratio of annual useful cooking energy output to the annual cooking energy input required for cooking as determined according to 4.3.2, 4.2.1, 4.1.3, 4.4.3, and 4.5.2, respectively, of Appendix I to this subpart.

(10) The energy factor for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges shall be the ratio of annual useful cooking energy output to the total annual energy input as determined according to 4.3.3, 4.2.3, 4.1.4, 4.4.5, and 4.5.3 respectively of Appendix I to this subpart.

(11) Other useful measures of energy consumption for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges shall be those measures of energy consumption which the Secretary of Energy determines are likely to assist consumers in making purchasing decisions and which are derived from the application of Appendix I to this subpart.

* * * * *

3. Section 430.24 is amended by adding a paragraph (i) to read as follows:

§ 430.24 Representations regarding measures of energy Consumption.

* * * * *

(i) *Kitchen ranges and ovens.* (1) Except as provided in paragraphs (i)(3) and (4) of this section, no manufacturer, distributor, retailer, or private labeler of kitchen ranges and ovens may make any representation with respect to, or based upon, a measure or measures of energy consumption for conventional ranges, conventional cooking tops, conventional ovens, microwave ovens, and microwave/conventional ranges described in section 430.22(i) unless a sample of sufficient size of each basic model for which such representation is made has been tested in accordance with applicable provisions of this subpart, such that, for each such measure of energy consumption, there is at least 95 percent confidence that the true mean of such measures of the basic model lies within ±5 percent of the mean of such measures of the sample.

(2) Any sample selected under this paragraph shall be comprised of units which are production units, or are representative of production units, of the basic model being tested.

(3) With respect to each basic model of conventional ranges and microwave/conventional ranges, representations made with respect to, or based upon, measures of energy consumption described in section 430.22(i) may be derived from test results obtained from application of the test method of Appendix I to this subpart to basic models of the conventional cooking tops and such conventional and microwave ovens as comprise the basic model of the conventional range or microwave/conventional range to which such representations apply.

(4) Whenever a rule applicable to kitchen ranges and ovens is prescribed under section 324 of the Act, section 430.24(i) shall not apply to any label covered by such rule, and all representations of any measure of energy consumption covered by such labeling rule shall be identical to the measure of energy consumption specified on the label.

* * * * *

4. Subpart B of Part 430 is amended to add an Appendix I, to read as follows:

APPENDIX I—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF CONVENTIONAL RANGES, CONVENTIONAL COOKING TOPS, CONVENTIONAL OVENS, MICROWAVE OVENS AND MICROWAVE/CONVENTIONAL RANGES

1. *Definitions.*

1.1 "Built-in" means the product is supported by surrounding cabinetry, walls, or other similar structures.

1.2 "Drop-in" means the product is supported by horizontal surface cabinetry.

1.3 "Electric heating element" means a surface unit on which cooking vessels are placed and then heated by electric resistance heaters.

1.4 "Forced convection" means a mode of baking that uses a fan to circulate the heated air within the oven compartment during cooking.

1.5 "Freestanding" means the product is not supported by surrounding cabinetry, walls, or other similar structures.

1.6 "Gas heating element" means a surface unit on which cooking vessels are placed and then heated by gas burners.

1.7 "Standard cubic foot of gas" means that quantity of gas that occupies one cubic foot when saturated with water vapor at a temperature of 60°F and a pressure of 30 inches of mercury (density of mercury equals 13.595 grams per cubic centimeter).

1.8 "Thermocouple" means a device consisting of two dissimilar metals which are joined together and, with their associated wires, are used to measure temperature by means of electromotive force.

2. *Test conditions.*

2.1 *Installation.*

2.1.1 *Conventional electric ranges, ovens and cooking tops and microwave/conventional ranges.* Free-standing conventional electric ranges, ovens, and cooking tops, and microwave/conventional ranges are to be set up with the back against, or as near as possible, a vertical wall and with the sides exposed to the ambient air. Built-in or wall-mounted conventional electric ranges, ovens, and cooking tops, and microwave/conventional ranges are to be installed in accordance with the manufacturer's instructions. Conventional electric ranges, ovens, and cooking tops, and microwave/conventional ranges are to be completely assembled for all tests, with all handles, knobs, guards and the like mounted in place. All electric resistance heaters, baking racks, and baffles shall be in place in accordance with manufacturer's instructions. Disconnect all electrical devices which use energy continuously. Do not disconnect or modify the circuit to any other electrical components. Conventional electric ranges, and cooking tops, ovens and microwave/conventional ranges shall be connected to an electrical supply circuit with voltage as specified in 2.2.1 with a watt-hour meter installed in the circuit. The watt-hour meter shall be as described in 2.9.1.

2.1.2 *Conventional gas ranges, ovens, and cooking tops and microwave/conventional ranges.* Install free-standing conventional gas ranges, ovens and cooking tops and microwave/conventional ranges with a vertical back wall, extending at least one foot above and one foot on either side of the appliance, and with no side walls. Install built-in conventional gas ranges, ovens and cooking tops and microwave/conventional ranges in accordance with the manufacturer's installation instructions. All gas burners, baking racks, and baffles shall be in place, in accordance with manufacturer's instructions. Conventional gas ranges, ovens, and cooking tops and microwave/conventional ranges shall be connected to a gas supply line with a gas meter installed between the supply line and the range, oven, or cooking top being tested, according to manufacturer's specifications. The gas meter shall be as described in 2.9.2. Conventional gas ranges, ovens and cooking tops and microwave/conventional ranges with electrical ignition devices or other electrical components shall be connected to an electrical supply circuit of nameplate voltage with a watt-hour meter installed in the circuit. The watt-hour meter shall be as described in 2.9.1. Disconnect all electrical devices which use energy continuously. Do not disconnect or modify the circuit to any other electrical components.

2.1.3. *Microwave ovens.* Install the microwave oven in accordance with the manufacturer's instructions and connect to an electrical supply circuit with voltage as specified in section 2.2.1. A watt-hour meter shall be installed in the circuit and shall be as described in 2.9.1.

2.2 *Energy supply.*

2.2.1 *Electrical supply.* Maintain the electrical supply to the conventional range, conventional cooking top, conventional oven, and microwave/conventional range at 240/120 volts except that basic models rated only at 208/120 volts shall be tested at that rating. Maintain the electrical supply to a microwave oven at 120 volts and at 60 cycles per second. In every case, maintain the voltage within one percent of the voltage at which the appliance is tested.

2.2.2 *Gas supply.*

2.2.2.1 *Gas burner adjustments.* Gas ranges, ovens, and cooking tops and microwave/conventional ranges shall be tested with all of the gas burners adjusted in accordance with the installation or operation instructions provided by the manufacturer.

2.2.2.2 *Natural gas.* For tests using natural gas maintain the gas supply to the unit under test at the normal inlet test pressure immediately ahead of all controls at 7 to 10 inches of water column. The regulator outlet pressure at normal test pressure shall be approximately that recommended by the manufacturer. The natural gas supplied should have a heating value of approximately 1,025 Btu's per standard cubic foot. The actual hearing value, H_n, in Btu's per standard cubic

foot, for the natural gas to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using a standard continuous flow calorimeter as described in 2.9.4. or by the purchase of bottled natural gas whose Btu rating is certified to be at least as accurate a rating as could be obtined from measurements taken with a standard continuous flow calorimeter as described in 2.9.4.

2.2.2.3 *Propane gas.* For tests using propane gas maintain the gas supply to the unit under test at the normal inlet test pressure immediately ahead of all controls at 11 to 13 inches of water column. The regulator outlet pressure at normal test pressure shall be approximately that recommended by the manufacturer. The propane gas supplied should have a heating value of approximately 2,500 Btu's per standard cubic foot. The actual heating value, H_p, in Btu's per standard cubic foot, for the propane gas to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using a standard continuous flow calorimeter as described in 2.9.4 or by the purchase of bottled propane gas whose Btu rating is certified to be at least as accurate a rating as could be obtained from measurements taken with a standard continuous flow calorimeter as described in 2.9.4.

2.3 *Air circulation.* Maintain air circulation in the room sufficient to secure reasonably uniform temperature distribution, but do not cause a direct draft on the unit under test.

2.4 *Setting the conventional oven thermostat.*

2.4.1 *Conventional electric oven.* Install a thermocouple approximately in the center of the usable baking space. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in 2.9.3.2. Adjust or determine the conventional electric oven thermostat setting which will provide an average internal temperature of 325±5° F above room temperature. Determine the average internal temperature from the maximum and minimum temperatures measured in three consecutive "cut-off/cut-on" actions of the electric resistance heaters, excluding the initial "cut-off/cut-on" action, by the thermostat after the specified temperature rise has been attained by the conventional electric oven. Remove the thermocouple after the thermostat has been set.

2.4.2 *Conventional gas oven.* Install five parallel-connected weighted thermocouples, one located at the center of the conventional gas oven's usable baking space and the other four equally spaced between the center and the corners of the conventional gas oven on the diagonals of a horizontal plane through the center of the conventional gas oven. Each weighted thermocouple shall be constructed of a copper disc that is 1-inch in diameter and ⅛-inch thick. The two thermocouple wires shall be located in two holes in the disc spaced ½-inch apart, with each hole being located ¼-inch from the center of the disc. Both thermocouple wires shall be silver-soldered to the copper disc. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in 2.9.3.2. Adjust or determine the conventional gas oven thermostat setting which will provide an average internal temperature of 325±5°F above room temperature obtained from the maximum and minimum temperatures measured in three consecutive "cut-off/cut-on" actions of the gas burners, excluding the initial "cut-off/cut-on" action, by the thermostat after the specified temperature rise has been attained by the conventional gas oven. Remove the thermocouples after the thermostat has been set.

2.5 *Ambient room air temperature.* Maintain the ambient room air temperature, T_r, at 77±9°F as measured at least 5 feet and not more than 8 feet from the nearest surface of the unit under test and approximately 3 feet above the floor. The temperature shall be measured with a thermometer with an accuracy as indicated in 2.9.3.1.

2.6 *Normal nonoperating temperature.*

2.6.1 *Conventional electric oven.* The normal nonoperating temperature for a conventional electric oven is the temperature within two degrees Fahrenheit of the ambient room air temperature as determined in 2.5. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in 2.9.3.2.

2.6.2 *Conventional electric cooking top.* The normal nonoperating temperature for a conventional electric cooking top is within five degrees Fahrenheit of the ambient room air temperature as determined in 2.5.

2.6.3 *Conventional gas oven.* The normal nonoperating temperature for a conventional gas oven is the temperature within two degrees Fahrenheit of the temperature of a conventional gas oven of the same basic model which has been exposed to air at the ambient room air temperature, as described in 2.5, for at least 24 hours while not operating, with the oven door closed and with all pilot lights on and adjusted in accordance with the manufacturer's instructions. Provide a temperature indicator system for measuring the temperature of the oven with an accuracy as indicated in 2.9.3.2.

2.6.4 *Conventional gas cooking top.* The normal non-operating temperature for a conventional gas cooking top is the temperature within five degrees Fahrenheit of the temperature of a conventional gas cooking top of the same basic model which has been exposed to air at the ambient room air temperature, as determined in 2.5 for at least 24 hours while not operating, with all pilot lights on and adjusted in accordance with the manufacturer's instructions.

2.6.5 *Microwave oven.* Normal nonoperating temperature for a microwave oven is within two degrees Fahrenheit of the ambient room air temperature as determined in 2.5. The equipment for measuring the oven's temperature shall be as described in 2.9.3.4.

2.7. *Test blocks.*

2.7.1 *Test block size.*

2.7.1.1. *Conventional oven.* The test block, W_1, shall be made of aluminum alloy No. 6061, with a specific heat of 0.23 Btu's/lb-° F and with any temper that will give a coefficient of thermal conductivity of 0.37 to 0.41 cal/cm-° C-sec. The block shall be 6.25±.05 inches in diameter, approximately 2.8 inches high and shall weigh 8.5±0.1 lbs. The block shall have a hole at its top in the center. The hole shall be .08 inch in diameter and be 0.80 inch deep. The bottom of the block shall be flat to within ± .002 inch. The block shall be finished with an anodic black coating with a minimum thickness of 0.001 inch incorporating an inorganic black dye.

2.7.1.2 *Conventional cooking top.*

2.7.1.2.1 *Small surface unit.* The test block, W_s, shall be made of aluminum alloy No. 6061, with a specific heat of 0.23 Btu's/lb-° F and with any temper that will give a coefficient of thermal conductivity of 0.37 to 0.41 cal/cm-° C-sec. The block shall be 6.25± .05 inches in diameter, approximately 2.8 inches high and shall weigh 8.5±0.1 lbs. The block shall have a hole at its top in the center. The hole shall be .08 inch in diameter and 0.80 inch deep. The bottom of the block shall be flat to within ±.002 inch.

2.7.1.2.2 *Large surface unit.* The test block, W_s, shall be made of aluminum alloy No. 6061, with a specific heat 0.23 Btu's/lb-°F and with any temper that will give a coefficient of thermal conductivity of 0.37 to 0.41 cal/cm-° C-sec. The block shall be 9.0±.05 inches in diameter and approximately 3.0 inches high and shall weigh 19.0±0.1 lbs. The block shall have a hole at its top in the center. The hole shall be .08 inch in diameter and 0.80 inch deep. The bottom of the block shall be flat to within ±.002 inch.

2.7.2 *Thermocouple installation.* Install the thermocouple such that the thermocouple junction (where the thermocouple contacts the test block) is at the bottom of the hole provided in the test block and that the thermocouple junction makes good thermal contact with the aluminum block. If the test blocks are to be water cooled between tests the thermocouple hole should be sealed, or other steps taken, to insure that the thermocouple hole is completely dry at the start of the next test. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in 2.9.3.2.

2.7.3 *Test block temperature.* Maintain the initial temperature of the test blocks, T_i within ± ° F of the ambient room air temperature as specified in 2.5.

2.8 *Test beakers.*

2.8.1 *Test beaker size.* The five test beakers shall be made of thin walled glass. Two of the test beakers shall have an inside diameter of approximately 85 millimeters (mm). Three of the test beakers shall have an inside diameter of approximately 110 mm.

2.8.2 *Test beaker load.* Fill one of the 85 mm diameter test beakers with 275 milliliters (ml) ±2.75 ml of distilled water containing 1 percent by weight sodium chloride (NaCl). Fill one of the 85 mm diameter test beakers with 500 ml ±5.0 ml of distilled water containing 1 percent by weight NaCl. Fill the 110 mm diameter test beakers with 1,000 ml ±10.0 ml of distilled water containing 1 percent by weight NaCl.

2.8.2.1 *Test beaker water load temperature.* Maintain the initial temperature of the test beaker water load within ±4° F of ambient room air temperature. The temperature shall be measured with a thermometer or other equipment with an accuracy as indicated in 2.9.3.4.

2.9 *Instrumentation.* Perform all test measurements using the following instruments, as appropriate:

2.9.1. *Watt-hour meter.* The watt-hour meter shall have a resolution of 1.0 watt-hour and a maximum error no greater than 1.5 percent of the measured value for any demand greater than 100 watts.

2.9.2 *Gas meter.* The gas meter to be used for measuring the gas consumed by the gas burners of the over or cooking top shall have a resolution of 0.01 cubic feet and a maximum error no greater than 1.0 percent of the measured value for any demand greater than 2.2 cubic feet per hour. The gas meter to be used for measuring the gas consumed by the pilot lights shall have a resolution of 0.001 cubic feet and have a maximum error no greater than 2.0 percent of the measured value.

2.9.3 *Temperature measurement equipment.*

2.9.3.1 *Thermometer.* The room thermometer shall have an error no greater than ±1° F over the range 65° F to 90 °F.

2.9.3.2 *Temperature indicator system for measuring oven temperature.* The equipment for measuring conventional oven temperature shall have an error no greater than ±4° F over the range of 65° to 400° F.

2.9.3.3 *Temperature indicator system for measuring test block temperature.* The system shall have an error no greater than 2° F when measuring specific temperatures over the range of 65° F to 330° F. It shall also have an error no greater than 2° F when

measuring any temperature difference up to 240° F within the above range.

2.9.3.4 *Microwave oven test load temperatures.* The thermometer or other equipment used to measure the microwave oven temperature and its test load temperature shall have an error no greater than 1° F over the range of 65° F to 140° F.

2.9.4 *Standard continuous flow calorimeter.* The calorimeter shall have an operating range of 750 to 3,500 Btu's per cubic foot. The maximum error of the basic calorimeter shall be no greater than 0.2 percent of the actual heating value of the gas used in the test. The indicator readout shall have a maximum error no greater than 0.5 percent of the measured value within the above operating range and a resolution of 0.2 percent of the full scale reading of the indicator instrument.

2.9.5 *Wattmeter.* The wattmeter shall have a resolution of 0.2 watt and a maximum error no greater than 5 percent of the measured value over the range of 0 to 10 watts.

3. *Test methods and measurements.*

3.1 *Test methods.*

3.1.1. *Conventional oven.* Perform a test by establishing the testing conditions set forth in 2 of this Appendix, and adjust any pilot lights of a conventional gas oven in accordance with the manufacturer's instructions and turn off the gas flow to the conventional cooking top. Set the conventional oven test block approximately in the center of the usable baking space. The temperature of the conventional oven shall be its normal nonoperating temperature as described in 2.6.1 or 2.6.3. Turn the oven thermostat to the setting which provides an average internal temperature of 325°± 5° F above ambient temperature. If there is a special control or mode of operation on the oven, set for normal baking. If an oven permits baking by either forced convection using a fan, or without forced convection the oven is to be tested in each baking mode. The oven shall remain on for at least one complete thermostat "cut-off/cut-on" of the electrical resistance heaters or gas burners after the test block temperature has increased 234° F above its initial temperature.

3.1.1.1. *Self-cleaning operation of a conventional oven.* Perform a test by establishing the testing conditions set forth in 2 of this Appendix. Adjust any pilot lights of a conventional gas oven in accordance with the manufacturer's instructions and turn off the gas flow to the conventional cooking top. The temperature of the conventional oven shall be its normal nonoperating temperature as described in 2.6.1 or 2.6.3. Then, set the conventional oven self-cleaning process in accordance with the manufacturer's instructions. If the self-cleaning process is adjustable, use the average time recommended by the manufacturer for a moderately soiled oven.

3.1.1.2. *Continuously burning pilot lights of a conventional gas oven.* Perform a test by establishing the test conditions set forth in 2 of this Appendix. Adjust any pilot lights of a conventional gas oven in accordance with the manufacturer's instructions and turn off the gas flow to the conventional cooking top. Meter the gas consumption of the pilot lights under test for a period, L_o, of at least 24 hours.

3.1.2 *Conventional cooking top.* Perform a test by establishing the testing conditions set forth in 2 of this Appendix. Adjust any pilot lights of a conventional gas cooking top in accordance with the manufacturer's instructions and turn off the gas flow to the conventional oven. The temperature of the conventional cooking top shall be its normal nonoperating temperature as described in 2.6.2 or 2.6.4. Then, set the test block in the center of the heating element under test. The small test block, W_2, shall be used on electric heating elements of 7 inches or less in diameter. The large test block, W_3, shall be used on electric heating elements over 7 inches in diameter and on all gas heating elements. Energize the heating element at its maximum energy input rate (100 percent). When the test block reaches 144° F above its initial test block temperature, immediately reduce the energy input rate to 25±5 percent of the maximum energy input rate. After 15±0.1 minutes at the reduced energy setting, turn off the gas or electric heating element under test.

3.1.2.1 *Continuously burning pilot lights of a conventional gas cooking top.* Perform a test by establishing the test conditions set forth in 2 of this Appendix. Adjust any pilot lights of a conventional gas cooking top in accordance with the manufacturer's instructions and turn off the gas flow to the conventional oven. Meter the gas consumption of the pilot lights under test for a time, L_o, of at least 24 hours.

3.1.3 *Microwave oven.* Perform the tests by establishing the testing conditions set forth in 2 of this Appendix. Four tests are to be conducted with the water test loads in the following sequence: 2,000 ml, 1,000 ml, 500 ml, and 275 ml. For the 2,000 ml test, set two of the 110 mm diameter test beakers, each containing 1,000 ml of the specified water load, side by side, in the approximate center of the load carrying surface of the oven, and operate the microwave oven at its maximum microwave power setting until the temperature of the water load has been raised 45°±9° F. Allow one minute for changing the test load beakers between each of the tests. For the 1,000 ml test, set one of the 110 mm diameter test beakers containing 1,000 ml of the specified water load in approximately the center of the load carrying surface of the oven, and operate the microwave oven at its maximum microwave power setting until the temperature of the water load has been raised 45°±9° F. For the 500 ml test, set one of the 85 mm diameter test beakers containing 500 ml of the specified water load in approximately the center of the load carrying surface of the oven, and operate the microwave oven at its maximum microwave power setting until the temperature of the water load has been raised 45°±9° F. For the 275 ml test, set the 85 mm diameter test beaker containing 275 ml of the specified water load in approximately the center of the load carrying surface of the oven, and operate the microwave oven at its maximum microwave power setting until the temperature of the water load has been raised 45°±9° F.

3.2 *Test measurements.*

3.2.1 *Conventional oven test energy consumption.* Measure the block temperature, T_A, and the energy consumed, E_A, at the end of the last "ON" period of the conventional oven before the block reaches T_O (T_O is 234° F above the initial block temperature, T_I). Measure the block temperature, T_B, and the energy consumed E_B, at the beginning of the next "ON" period. Measure the block temperature, T_C, and the energy consumed, E_C, at the end of that "ON" period. Measure the block temperature, T_D, and the energy consumed E_D, at the beginning of the following "ON" period. Energy measurements for E_A, E_B, E_C and E_D should be expressed in watt-hours for conventional electric ovens or standard cubic feet of gas for conventional gas ovens. For a gas oven measure in watt-hours any electrical energy, E_{IO}, consumed by an ignition device or other electrical components required for the operation of a conventional gas oven while heating the test block to T_O.

3.2.1.1 *Energy consumption of self-cleaning operation.* Measure the self-cleaning conventional electric or gas oven energy consumption, E_S, specified as the number of watt-hours of electrical energy or standard cubic feet of gas, respectively, consumed during the self-cleaning test set forth in 3.1.1.1. For a gas oven also measure in watt-hours any electrical energy, E_{IS}, consumed by an ignition device or other electrical components required during the self-cleaning test.

3.2.1.2 *Gas consumption of continuously burning pilot lights.* Measure the gas consumption of the pilot lights, P_o, in standard cubic feet of gas and the test duration, L_o, in hours for the test set forth in 3.1.1.2.

3.2.1.3 *Clock power.* If the conventional oven, conventional range, or microwave/conventional range includes an electric clock which is on continuously, and the power rating in watts, of this feature is not known, measure the clock power drain, PR, in watts.

3.2.2 *Conventional surface unit test energy consumption.* For the gas or electric heating element under test, measure the energy consumption, E_{CT}, in standard cubic feet of gas or watt-hours of electricity, respectively, and the test block temperature, T_{CT}, at the end of the 15 minute (reduced input setting) test interval for the test specified in 3.1.2 and the total time, T_T, in hours, that the element is under test. Measure any electrical energy, E_{IC}, consumed by an ignition device of a gas heating element in watt-hours.

3.2.2.1 *Gas consumption of continuously burning pilot lights.* If the conventional gas cooking top under test has one or more continuously burning pilot lights, measure the gas consumed during the test by the pilot lights, P_c, in standard cubic feet of gas, and the test duration, L_c, in hours as specified in 3.1.2.1.

3.2.3 *Microwave oven test energy consumption.* Measure the initial, T_{Ii}, and final, T_{Fi}, temperatures, in degrees Fahrenheit (°F), of the water test load for the 2,000 ml, 1,000 ml, 500 ml and 275 ml tests. The final temperature, T_{Fi}, shall be measured after the test load has been stirred to insure uniform temperature distribution. Measure the elapsed time, t_i, in seconds, until the temperature rise fo the water load is 45±9°F.

Measure for each test specified in 3.1.3 the electrical input energy, E_i, in watt-hours consumed by the microwave oven during the elapsed time, t_i.

3.3 *Recorded values.*

3.3.1 Record the test room temperature, T_R, for each test.

3.3.2 Record measured test block weights W_1, W_2, W_3 in pounds.

3.3.3 Record the initial temperature, T_I, of the test block under test.

3.3.4 Record the conventional oven test measurements T_A, E_A, T_B, E_B, T_C, E_C, T_D, E_D, and E_{IO}.

3.3.5 Record the measured energy consumption, E_S, and for a gas oven, any electrical energy, E_{IS}, for the test of the self-cleaning operation of a conventional oven.

3.3.6 Record the gas consumption, P_o, and the elapsed time, L_o, that any continuously burning pilot lights of a conventional oven are under test.

3.3.7 Record the clock power measurement of rating, PR, in watts.

3.3.8 For the heating element under test, record the energy consumption, E_{CT}, the final test block temperature, T_{CT}, the total test time, T_T, and any electrical energy consumption, E_{IC}.

3.3.9 Record the gas consumption, P_c, and the elapsed time, L_c, that any continuously burning pilot lights of a conventional cooking top are under test.

3.3.10 Record the heating value, H_n, as determined in 2.2.2.2 for the natural gas supply.

3.3.11 Record the heating value, H_p, as determined in 2.2.2.3 for the propane gas supply.

3.3.12 Record the electrical input energy, E_i, the elapsed time, t_i, and initial, T_{Ii}, and final, T_{Fi}, temperature of the water load for each microwave oven test.

4. *Calculation of derived results from test measurements.*

4.1 *Conventional oven.*

4.1.1 *Conventional oven test energy consumption.*

4.1.1.1 *Conventional electric oven test energy consumption.* For a conventional electric oven, calculate the test energy consumption, E_O, with the aid of the figure in 5 of this Appendix, expressed in watt-hours, and corresponding to T_O and defined a s:

$$E_O = E_{AB} + \left[\left(\frac{T_O - T_{AB}}{T_{CD} - T_{AB}}\right) \times (E_{CD} - E_{AB})\right]$$

where,

$$T_{AB} = \frac{T_A + T_B}{2}$$

$$T_{CD} = \frac{T_C + T_D}{2}$$

$$E_{AB} = \frac{E_A + E_B}{2}$$

$$E_{CD} = \frac{E_C + E_D}{2},$$

where

T_O = 234°F above the initial block temperature

T_A = Block temperature at the end of the last "ON" period of the conventional oven before the test block reaches T_O.

E_A = Energy consumed in watt-hours at the end of the last "ON" period before the test block reaches T_O.

T_B = Block temperature at the beginning of the "ON" period following the measurement of T_A.

E_B = Energy consumed in watt-hours at the beginning of the "ON" period following the measurement of T_A.
T_C = Block temperature at the end of the "ON" period which starts with T_B.
E_C = Energy consumed in watt-hours at the end of the "ON" period which starts with T_B.
T_D = Block temperature at the beginning of the "ON" period which follows the measurement of T_C.
E_D = Energy consumed in watt-hours at the beginning of the "ON" period which follows the measurement of T_C.

4.1.1.2 *Conventional gas oven test energy consumption.* For a conventional gas oven, calculate the gas test energy consumption, E_o, with the aid of the figure in 5 of this Appendix, expressed in Btu's and corresponding to T_o and defined as:

$$E_O=(E_{AB}\times H)+\left[\left(\frac{T_O-T_{AB}}{T_{CD}-T_{AB}}\right)\times(E_{CD}-E_{AB})\times H\right],$$

where

H = Either H_n or H_p, the heating value of the gas used in the test as specified in 2.2.2.2 and 2.2.2.3, expressed in Btu's per standard cubic foot.

$$T_{AB}=\frac{T_A+T_B}{2}$$

$$T_{cD}=\frac{T_C+T_D}{2}$$

$$E_{AB}=\frac{E_A+E_B}{2}$$

$$E_{CD}=E_C+E_D,$$

where

T_O = 234° F above the intial block temperature.
T_A = Block temperature at the end of the last "ON" period of the conventional oven before the test block reaches T_O.
E_A = Volume of gas consumed in standard cubic feet at the end of the last "ON" period before the test block reaches T_O.
T_B = Block temperature at the beginning of the "ON" period following the measurement of T_A.
E_B = Volume of gas consumed in standard cubic feet of gas at the beginning of the "ON" period following the measurement T_A.
T_C = Block temperature at the end of the "ON" period which starts with T_B.
E_C = Volume of gas consumed in standard cubic feet of gas at the end of the "ON" period which starts with T_B.
T_D = Block temperature at the beginning of the "ON" period which follows the measurement of T_c.
E_D = Volume of gas consumed in standard cubic feet of gas at the beginning of the "ON" period which follows the measurement of T_c.

4.1.1.3 *Average test energy consumption.* If the conventional oven can be operated in more than one baking mode, such as with and without forced convection, determine the average test energy consumption, E_O and E_{IO}, using the following equations:

$$E_O=\frac{1}{n}\sum_{i=1}^{n}(E_O)_i$$

$$E_{IO}=\frac{1}{n}\sum_{i=1}^{n}(E_{IO})_i,$$

where

n = Number of modes in which the oven was tested.
E_O = Test energy consumption in each baking mode as determined in 4.1.1.
E_{IO} = Electrical energy consumption of a gas oven in each baking mode as measured in 3.2.1.

4.1.2 *Conventional oven annual energy consumption.*

4.1.2.1. *Annual cooking energy.*

4.1.2.1.1. *Annual primary cooking energy.* Calculate the annual primary energy consumption for cooking, E_{CO}, expressed in kilowatt-hours for electric ovens and in Btu's for gas ovens, and defined as:

$$E_{CO}=\frac{E_O\times H_E\times O_o}{W_1\times C_p\times T}$$

E_O = Test energy consumption as calculated in 4.1.1.1 or 4.1.1.3.
H_E = 3.412, conversion factor for watt-hours to Btu's.
O_o = 47.09 kWh's, annual useful cooking energy output of conventional electric oven.
W_1 = Measured weight of test block in pounds.
C_p = 0.23 Btu/lb-° F, specific heat of test block.
T = 234° F, temperature rise of test block.

or,

$$E_{CO}=\frac{E_O\times O_o}{W_1\times C_p\times T}$$

for gas ovens, where
E_O = Test energy consumption as calculated in 4.1.1.2 or 4.1.1.3.
O_o = 160,700 Btu's, annual useful cooking energy output of conventional gas oven.
W_1, C_p, and T are the same as defined above.

4.1.2.1.2 *Annual secondary cooking energy for gas ovens.* Calculate the annual secondary energy consumption for cooking, E_{SO}, expressed in kilowatt-hours and defined as:

$$E_{SO}=\frac{E_{IO}\times O_o}{W_1\times C_p\times T},$$

where

E_{IO} = Electrical test energy consumption according to 3.2.1 or as calculated in 4.1.1.3.
O_o = 47.09 kWh's, annual useful cooking energy output.
W_1, C_p, and T are as defined in 4.1.2.1.1.

4.1.2.2 *Annual energy consumption of any continuously burning pilot lights.* Calculate the annual energy consumption of any continuously burning pilot lights, E_{po}, expressed in Btu's and defined as:

$$E_{po}=\frac{P_o\times H}{L_o}(A-B),$$

where

P_o = Cubic feet of gas consumed by any continuously burning pilot lights as determined in 3.2.1.2.
$H=H_n$ or H_p, the heating value of the gas used in the test as specified in 2.2.2.2 and 2.2.2.3 in Btu's per standard cubic foot.
L_o = Elapsed test time in hours for any continuously burning pilot lights tested.
A = 8,760, number of hours in a year.
B = 300, number of hours any continuously burning pilot lights contribute to the heating of an oven for cooking food.

4.1.2.3 *Annual conventional oven self-cleaning energy.*

4.1.2.3.1 *Primary energy.* Calculate the annual primary energy consumption for conventional oven self-cleaning operations, E_{SC}, expressed in kilowatt-hours for electric ovens and in Btu's for gas ovens, and defined as:
$E_{SC}=E_S\times S_s\times C$, for electric ovens,
where
E_S = Energy consumption in watt-hours as measured in 3.2.1.1.
S_s = 11, average number of times a self-cleaning operation of a conventional electric oven is used per year.
C = .001 W/kW conversion factor of watts to kilowatts.
or
$E_{SC}=E_S\times H\times S_s$, for gas ovens,
where
E_S = Energy consumption in cubic feet of gas per oven tested according to 3.2.1.1.
$H=H_n$ or H_p, the heating value of the gas used in the test as specified in 2.2.2.2 and 2.2.2.3 in Btu's per standard cubic foot.
S_s = 7, average number of times a self-cleaning operation of a conventional gas oven is used per year.

4.1.2.3.2 *Secondary self-cleaning energy for gas ovens.* Calculate the annual secondary energy consumption for self-cleaning operations of a gas oven, E_{SS}, expressed in kilowatt-hours and defined as:

$$E_{SS}=E_{IS}\times S_s\times C,$$

where

E_{IS} = Electrical energy consumed during the self-cleaning operation of a conventional gas oven, as measured in 3.2.1.1.
S_s and C are the same as defined in 4.1.2.5.1.

4.1.2.4 *Annual clock energy consumption.* Calculate the annual energy consumption of any constantly operating electric clock, E_{CL}, expressed in kilowatt-hours and defined as:

$$E_{CL}=PR\times KH,$$

where

PR = Power rating, in watts, of clock which is on continuously.
KH = 8.76, thousands of hours in a year.

4.1.2.5 *Total annual energy consumption of a single conventional oven.*

4.1.2.5.1 *Conventional electric oven.* Calculate the total annual energy consumption of a conventional electric oven, E_{AO}, expressed in kilowatt-hours and defined as:

$$E_{AO}=E_{CO}+E_{SC}+E_{CL},$$

where

E_{CO} = Annual cooking energy consumption as determined in 4.1.2.1.1.
E_{SC} = Annual self-cleaning energy consumption as determined in 4.1.2.3.1.
E_{CL} = Annual clock energy consumption as determined in 4.1.2.4.

4.1.2.5.2 *Conventional gas oven.* Calculate the total annual gas energy consumption of a conventional gas oven, E_{AOG}, expressed in Btu's and defined as:

$$E_{AOG}=E_{CO}+E_{PO}+E_{SC},$$

where

E_{CO} = Annual primary cooking energy consumption as determined in 4.1.2.1.1.
E_{PO} = Annual pilot energy consumption as determined in 4.1.2.2.
E_{SC} = Annual primary self-cleaning energy consumption as determined in 4.1.2.3.1.

If the conventional gas oven uses electrical energy, calculate the total annual electrical energy consumption, E_{AOE}, expressed in kilowatt-hours, and defined as:

$$E_{AOE}=E_{SO}+E_{SS}+E_{CL},$$

where

E_{SO} = Annual secondary cooking energy consumption as determined in 4.1.2.1.2.
E_{SS} = Annual secondary self-cleaning energy consumption as determined in 4.1.2.3.2.
E_{CL} = Annual clock energy consumption as determined in 4.1.2.4.

The total annual energy consumption of a conventional gas oven, E_{AO}, is comprised of E_{AOG}, expressed in Btu's, and E_{AOE}, expressed in kilowatt-hours, as computed above.

4.1.2.6 *Total annual energy consumption of multiple conventional ovens.* If the basic model of the conventional range, microwave/conventional range, or conventional oven includes more than one conventional oven, calculate the total annual energy consumption for all of the conventional ovens in the basic model, E_{TO}, expressed in kilowatt-hours per year for electrical energy and in Btu's per year for gas energy, with the following equation:

$$E_{TO}=E_{ACO}+E_{ASO}+E_{TPO}+E_{SC}+E_{SS}+E_{CL},$$

where gas and electrical energy are summed separately and where,

$$E_{ACO}=\frac{1}{n}\sum_{i=1}^{n}(E_{CO})_i,$$

average annual primary energy consumption for cooking, where
n = Number of conventional ovens in the basic model.
E_{CO} = Annual primary energy consumption for cooking as determined in 4.1.2.1.1.

$$E_{ASO}=\frac{1}{n}\sum_{i=1}^{n}(E_{SO})_i,$$

average annual secondary energy consumption for cooking, where
n = Number of conventional ovens in the basic model.
E_{SO} = Annual secondary energy consumption for cooking as determined in 4.1.2.1.2.

$$E_{TPO}=\sum_{i=1}^{n}$$

total annual energy consumption, of any pilot lights, where
E_{PO} = Annual energy consumption of any continuously burning pilot lights determined according to 4.1.2.2.

E_{SC}, E_{SS}, and E_{CL} are defined in 4.1.2.3.1, 4.1.2.3.2, and 4.1.2.4 respectively.

4.1.3 *Conventional oven cooking efficiency.*

4.1.3.1 *Cooking efficiency of a single conventional oven.* Calculate the conventional oven cooking efficiency, Eff_{AO}, using the following equations:
For electric ovens;

$$Eff_{AO}=\frac{O_o}{E_{CO}},$$

where

O_o = 47.09 kWh, annual useful cooking energy output.
E_{CO} = Annual cooking energy consumption as determined in 4.1.2.1.1.

For gas ovens;

$$Eff_{AO}=\frac{O_o}{I_o},$$

where
O_o = 160,700 Btu, annual useful cooking energy output.
I_o = Annual energy consumption for cooking = $E_{CO}+(E_{SO}\times H_s)$, where
E_{CO} = Annual primary energy consumption for cooking as determined in 4.1.2.1.1.
E_{SO} = Annual secondary energy consumption for cooking as determined in 4.1.2.1.2.
H_s = 3,412 Btu/kWh, conversion factor for kilowatt-hours to Btu's.

4.1.3.2 *Cooking efficiency of multiple conventional ovens.* If the basic model of the conventional range, micro-wave/conventional range, or conventional oven includes more than one conventional oven, calculate the cooking efficiency for all of the ovens Eff_{TO}, using the following equations:

$$Eff_{TO}=\frac{O_o}{E_{ACO}},$$

for electric ovens, where

O_o=47.09 kWh's per year, annual useful cooking energy output.

$$E_{ACO}=\frac{1}{n}\sum_{i=1}^{n}(E_{CO})_i,$$

the average annual cooking energy consumption, where

n=Number of conventional ovens in the basic model.

E_{CO}=Annual energy required for cooking for each oven as determined according to 4.1.2.1.1.

or,

$$Eff_{TO}=\frac{O_o}{I_{TO}}$$

for gas ovens, where

O_o=160,700 Btu's per year, annual useful cooking energy output.

$$I_{TO}=\frac{1}{n}\sum_{i=1}^{n}(I_o)_i,$$

the average annual energy consumption for cooking, where

n=Number of gas ovens in the basic model.

I_o=Annual energy consumption for cooking of each oven as determined according to 4.1.3.1.

4.1.4 *Energy factor for conventional ovens.*

4.1.4.1 *Energy factor of a single conventional oven.* Calculate the energy factor, or the ratio of useful cooking energy output to the total energy input, Ro, using the following equations:

For electric ovens,

$$R_O=\frac{O_o}{E_{AO}},$$

where

O_o=47.09 kWh's per year, annual useful cooking energy output.

E_{AO}=Total annual energy consumption as determined in 4.1.2.5.1.

For gas ovens,

$$R_O=\frac{O_o}{E_{AOG}+(E_{AOE}\times H_e)},$$

where

O_o=160,700 Btu's per year, annual useful cooking energy output.

E_{AOG}=Total annual gas energy consumption as determined in 4.1.2.5.2.

E_{AOE}=Total annual electrical energy consumption as determined in 4.1.2.5.2.

H_e=3,412 Btu per kWh, conversion factor for kilowatt-hours to Btu's.

4.1.4.2 *Energy factor for multiple conventional ovens.* If the basic model of the conventional range, microwave/conventional range, or conventional oven includes more than one conventional oven, calculate the energy factor for all of the ovens, R_{TO}, using the following equations:

For electric ovens,

$$R_{TO}=\frac{O_o}{E_{TO}},$$

where

O_o=47.09 kWh's per year, annual useful cooking energy output.

E_{TO}=Total energy consumption as determined according to 4.1.2.6.

For gas ovens,

$$R_{TO}=\frac{O_o}{E_{ACO}+E_{TPO}+E_{SC}+(E_{ASO}+E_{SS}+E_{CL})\times H_e},$$

where

O_o=160,700 Btu's per year, annual useful cooking energy output.

H_e=3,412 Btu/kWh, conversion factor for kilowatt-hours to Btu's.

E_{ACO}, E_{TPO}, and E_{ASO} as defined in 4.1.2.6.

E_{SC}, E_{SS}, and E_{CL} as defined in 4.1.2.3, 4.1.2.3.2, and 4.1.2.4 respectively.

4.2 *Conventional cooking top.*

4.2.1 *Conventional cooking top cooking efficiency.*

4.2.1.1 *Electric heating element cooking efficiency.* Calculate the cooking efficiency, Eff_{ES}, of the electric heating element under test, and defined as:

$$Eff_{ES}=W\times C_p\times\frac{T_{su}}{H_E\times E_{CT}},$$

where

W=Measured weight of test block, W_2 or W_3, expressed in pounds.

C_p=Specific heat of aluminum: 0.23 Btu's/lb-°F.

T_{su}=Temperature rise of the test block: final test block temperature, T_{CT}, as determined in 3.2.2, minus the initilatest block temperature, T_I, expressed in °F.

H_E=3.412 Btu's/wh, conversion factor of watt-hours to Btu's.

E_{CT}=Measured energy consumption, as determined according to 3.2.2, expressed in watt-hours.

4.2.1.1.1 *Conventional electric cooking top cooking efficiency.* Calculate the conventional electric cooking top cooking efficiency, Eff_{EC}, using the following equation:

$$Eff_{EC}=\frac{1}{n}\sum_{i=1}^{n}(Eff_{ES})_i,$$

where

n=Number of electric heating elements contained in the cooking top.

Eff_{ES}=The efficiency of each of the electric heating elements, as determined according to 4.2.1.1.

4.2.1.2 *Gas heating element cooking efficiency.* Calculate the cooking efficiency, Eff_{GS}, of the gas heating element under test, and defined as:

$$Eff_{GS}=\frac{W_3\times C_p\times T_{su}}{E},$$

where

W_3=Measured weight of test block according to 3.3.2, expressed in pounds.

C_p=Specific heat of aluminum, 0.23 Btu's/lb=°F.

T_{su}=Temperature rise of the test block: Final test temperature, T_{CT}, as determined in 3.2.2, minus the initial test block temperature, T_I, expressed in °F.

$$E=[(E_{CT}-E_{CP})\times H]+(E_{IC}\times H_E),$$

where

E_{CT}=Energy consumption for the gas heating element as defined in 3.2.2.

E_{IC}=Electrical energy consumed by an ignition device of a gas heating element.

H_E=Conversion factor of watt-hours to Btu's (3.412 Btu's/wh).

H=Either H_n or H_p, the value of the gas used in the test as specified in 2.2.2.2 and 2.2.2.3, expressed in Btu's per standard cubic foot of gas.

$E_{CP}=P\times T_T$, (pilot consumption, in standard cubic feet, during unit test) where

$$P=\frac{P_c}{L_c},$$

(pilot flow in standard cubic feet per hour) where

P_c=Any pilot lights gas consumption defined in 3.2.2.1.

L_c=Elapsed time of the cooking top pilot lights test as defined in 3.1.2.1.

T_T=The elapsed test time as defined in 3.2.2.

4.2.1.2.1 *Conventional gas cooking top cooking efficiency.* Calculate the cooking efficiency, Eff_{GC}, of a conventional gas cooking top using the following equation:

$$Eff_{GC}=\frac{1}{n}\sum_{i=1}^{n}(Eff_{GS})_i,$$

where

n=Number of gas heating elements contained in the cooking top.

Eff_{GS}=The efficiency of each gas heating element as determined according to 4.2.1.2.

4.2.2 *Conventional cooking top annual energy consumption.*

4.2.2.1 *Annual energy consumption of an electric cooking top.* Calculate the annual energy consumption of an electric cooking top, E_{CA}, in kilowatt-hours per year and defined as:

$$E_{CA}=\frac{O_{CT}}{Eff_{EC}},$$

where

O_{CT}=277.7 kWh per year, annual useful Cooking energy output.

Eff_{EC}=Conventional cooking top cooking efficiency as defined in 4.2.1.1.1.

4.2.2.2 *Annual energy consumption of a gas cooking top.*

4.2.2.2.1 *Annual energy consumption for cooking.* Calculate the annual energy consumption for cooking, E_{cc}, in Btu's per year for a gas cooking top and defined as:

$$E_{cc}=\frac{O_{CT}}{Eff_{GC}},$$

where

O_{CT}=948,000 Btu's, annual useful cooking energy output.

Eff_{GC}=The gas cooking top efficiency as defined in 4.2.1.2.1.

4.2.2.2.2 *Annual energy consumption of any continuously burning gas pilot lights.* Calculate the annual energy consumption of any continuously burning gas pilot lights of the cooking top, E_{pc}, in Btu's per year and defined as:

$$E_{pc}=P\times A\times H,$$

where

P=Pilot light flow rate as defined in 4.2.1.2.

A=The total number of hours in a year (8,760 hours).

H=Either H_n or H_p, the heating value of the gas used in the test as specified in 2.2.2.2 and 2.2.2.3, expressed in Btu's per standard cubic foot of gas.

4.2.2.2.3 *Total annual energy consumption of a conventional gas cooking top.* Calculate the total annual energy consumption of a conventional gas cooking top, E_{CA}, in Btu's per year and defined as:

$$E_{CA}=E_{cc}+E_{pc},$$

where

E_{cc}=Energy consumption for cooking as determined in 4.2.2.2.1.

E_{pc}=Annual energy consumption of the pilot lights as determined in 4.2.2.2.2.

4.2.3 *Conventional cooking top energy factor.* Calculate the energy factor, or ratio of useful cooking energy output for cooking to the total energy input, R_{CT}, as follows:

For an electric cooking top the energy factor is the same as the cooking efficiency as determined according to 4.2.1.1.1.

For gas cooking tops,

$$R_{CT}=\frac{O_{CT}}{E_{CA}},$$

where

O_{CT}=948,000 Btu's per year, annual useful cooking energy output of cooking top.

E_{CA}=Total annual energy consumption of cooking top determined according to 4.2.2.2.3.

4.3 *Conventional range.*

4.3.1 *Conventional range annual energy consumption.* Calculate the conventional range annual energy consumption, E_R, in kWh's per year for electrical energy and Btu's per year for gas energy, and defined as:

$$E_R=E_{AO}+E_{CA},$$

where gas and electrical energy are added separately, and where

E_{AO}=The conventional oven annual energy consumption in kWh's per year and or Btu's per year as determined in 4.1.2.5 or 4.1.2.6.

E_{CA}=The conventional cooking top annual energy consumption in kWh's per year or Btu's per year as defined in 4.2.2.

4.3.2 *Conventional range cooking efficiency.* Calculate the conventional range cooking efficiency, Eff_R and defined as the ratio of the annual useful energy output divided by the annual energy input required for cooking.

For an electric range,

$$Eff_R=\frac{O_R}{E_{CO}+E_{CA}},$$

where

O_R=324.8 kWh per year, annual useful cooking energy output.

E_{CO}=Annual oven energy consumption determined according to 4.1.2.1.1.

E_{CA}=Annual cooking top energy consumption determined according to 4.2.2.1.

For a gas range which does not use electric ignition,

$$Eff_R=\frac{O_R}{E_{CC}+E_{CO}},$$

where

O_R=1,109,000 Btu's per year, annual useful cooking energy output.

E_{CO}=As defined above.

E_{CC}=Annual energy consumption for cooking of gas cooking top as determined in 4.2.2.2.1.

For a conventional range which uses both gas and electrical energy:

$$Eff_R=\frac{O_R}{E_{CC}+E_{CO}+(E_{SO}\times H_e)},$$

where

O_R=1,109,000 Btu's per year, annual useful cooking energy output.

E_{CC}=Annual cooking top energy consumption for cooking determined according to 4.2.2.2.1.

E_{CO}=Annual oven primary energy consumption determined according to 4.1.2.1.1 and expressed in Btu's per year. For an electric oven multiply the consumption in kilowatt-hours per year by 3,412 (Btu's per kWh).

E_{SO}=Annual secondary energy consumption determined according to 4.1.2.1.2.
H_e=3,412 Btu's per kWh, conversion factor for kilowatt-hours to Btu's.

4.3.3 *Energy factor for conventional range.* Calculate the energy factor, or the ratio of the useful cooking energy output to the total energy input on a yearly basis for the complete range, R_R, and defined as:

$$R_R=\frac{O_R}{E_R},$$

where
O_R=1,109,000 Btu's, annual useful cooking energy output.
E_R=Total annual energy consumption as determined in 4.3.1 and with all values for electrical energy converted from kilowatt-hours to Btu's by multiplying by 3,412, Btu's per kWh.

4.4 *Microwave oven.*

4.4.1 *Microwave power output.* Calculate, for each test load, i, the microwave power output, MP_O, expressed in watts, and defined as:

$$(MP_O)_i=\frac{W_i\times F\times DT_i}{t_i},$$

where
W_i=Size of the test load, in milliliters (ml).
$DT_i=T_{Fi}-T_{Ii}$
where
T_{Fi}=The final temperature expressed in °F of the test load as defined in 3.2.3.
T_{Ii}=The initial temperature expressed in °F of the test load as defined in 3.2.3.
F=2.32 Watt-sec/Ml-°F (conversion factor used to convert milliliter-degrees Fahrenheit to watt-seconds).
t_i=The elasped test time, in seconds, as defined in 3.2.3.
i=Each test load.

4.4.2 *Specific microwave oven cooking efficiency for each test load.* Calculate the specific microwave oven cooking efficiency, e_i, for each test load (i), and defined as:

$$e_i=\frac{(MP_O)_i}{E_i}\times\frac{t_i}{S},$$

where
S=3,600 seconds (the number of seconds in one hour).
$(MP_O)_i$=The microwave power output in watts as defined in 4.4.1.
E_i=The energy consumption as defined in 3.2.3.
t_i=The elasped test time as defined in 3.2.3.
i=Each test load.

4.4.3 *Microwave oven cooking efficiency.* Calculate the microwave oven cooking efficiency, $e_{(avg)}$, and defined as:

$$e_{(avg)}=\frac{1}{m}\sum_{i=1}^{m}e_i$$

m=4 (the number of test loads).
e_i=The specific microwave cooking efficiency as defined in 4.4.2.

4.4.4 *Microwave oven annual energy consumption.* Calculate the microwave oven annual energy consumption, E_{MO}, in kWh's per year, and defined as:

$$E_{MO}=\frac{MO}{e_{(avg)}}+(PR\times KH),$$

where
MO=34.2 kWh's per year, the microwave oven annual useful cooking energy output.
$e_{(avg)}$=The microwave oven rated efficiency as defined in 4.4.3.
PR=The power rating of features (such as clocks), expressed in watts. The power rating is the power drawn from the electrical supply when the microwave oven is turned off.
KH=8.76, the number of thousand hours in a year.

4.4.5 *Energy factor for microwave oven.* Calculate the energy factor or the ratio of the useful cooking energy output to total energy input on a yearly basis, R_{MO}, and defined as:

$$R_{MO}=\frac{MO}{E_{MO}},$$

where
MO=34.2 kWh, annual useful cooking energy output.
E_{MO}=Annual total energy input as determined in 4.4.4.

4.5 *Microwave/conventional range.*

4.5.1 *Annual energy consumption.*

4.5.1.1 *Annual energy consumption of the conventional oven.*

4.5.1.1.1 *Annual primary energy consumption for cooking.* Calculate the annual primary energy consumption for cooking of a conventional oven in combination with a microwave oven, E_{COM}, expressed in Btu's for gas ovens and in kilowatt-hours for electric ovens, with the following equation:

$$E_{COM}=K\times E_{CO},$$

where
K=0.8196, estimated fraction of usage for a conventional oven due to microwave oven usage.
E_{CO}=Energy consumption as calculated in 4.1.2.1.1.

4.5.1.1.2 *Annual secondary energy consumption for gas ovens.* Calculate the annual secondary energy consumption for cooking of a gas oven in combination with a microwave oven, E_{SOM}, expressed in kilowatt-hours, with the following equation:

$$E_{SOM}=K\times E_{SO},$$

where
K=.8196, as defined in 4.5.1.1.1.
E_{SO}=Energy consumption as calculated in 4.1.2.1.2.

4.5.1.2 *Annual energy consumption of the cooking top.* Calculate the annual energy consumption of a cooking top in combination with a microwave oven, E_{CAM}, expressed in kilowatt-hours for an electric cooking top and in Btu's for a gas cooking top, with the following equations:
For electric cooking top;

$$E_{CAM}=L\times E_{CA},$$

where
L=0.9076, estimated fraction of usage for a conventional cooking top due to microwave oven usage.
E_{CA}=Energy consumption as calculated in 4.2.2.
For gas cooking tops;

$$E_{CAM}=\left(\frac{L\times O_{CT}}{Eff_{GC}}\right)+(A\times P\times H).$$

where O_{CT}, A, P, H, and Eff_{GC} as defined in 4.2.1.2.1.2.

4.5.1.3 *Total annual energy consumption.* Calculate the total annual energy consumption of a microwave/conventional range, E_{RM}, expressed in kilowatt-hours per year for electrical energy and in Btu's per year for gas energy, with the following equation:

$$E_{RM}=E_{COM}+E_{SOM}+E_{PO}+E_{SC}+E_{SS}+E_{CL}+E_{CAM}+E_{MO},$$

where gas and electrical energy are added separately and where
E_{COM}=Primary energy consumption for cooking as determined in 4.5.1.1.1.
E_{SOM}=Secondary energy consumption for cooking as determined in 4.5.1.1.2.
E_{PO}=Gas pilot energy consumption as determined in 4.1.2.2.
E_{SC}=Primary energy consumption for self-cleaning, as determined in 4.1.2.3.1.
E_{SS}=Secondary energy consumption for self-cleaning as determined in 4.1.2.3.2.
E_{CL}=Clock energy consumption as determined in 4.1.2.4.
E_{CAM}=Cooking top energy consumption as determined in 4.5.1.2.
E_{MO}=Microwave oven energy consumption as determined in 4.4.4.

4.5.2 *Cooking efficiency of microwave/conventional range.* Calculate the cooking efficiency of a microwave/conventional range, Eff_{RM}, and defined as:
For an all electric range;

$$Eff_{RM}=\frac{O_{RM}}{E_{COM}+E_{CAM}+E_{MO}-(PR\times KH)},$$

where
O_{RM}=324.8 kWh per year, annual useful cooking energy output.
PR and KH as defined in 4.4.4.
E_{COM}, E_{CAM}, and E_{MO} as defined in 4.5.1.3.
For a range which uses both gas and electrical energy,

$$Eff_{RM}=\frac{O_{RM}}{E_{COM}+E_{CAM}-E_{pc}+[(E_{SOM}+E_{MO})\times H_e]},$$

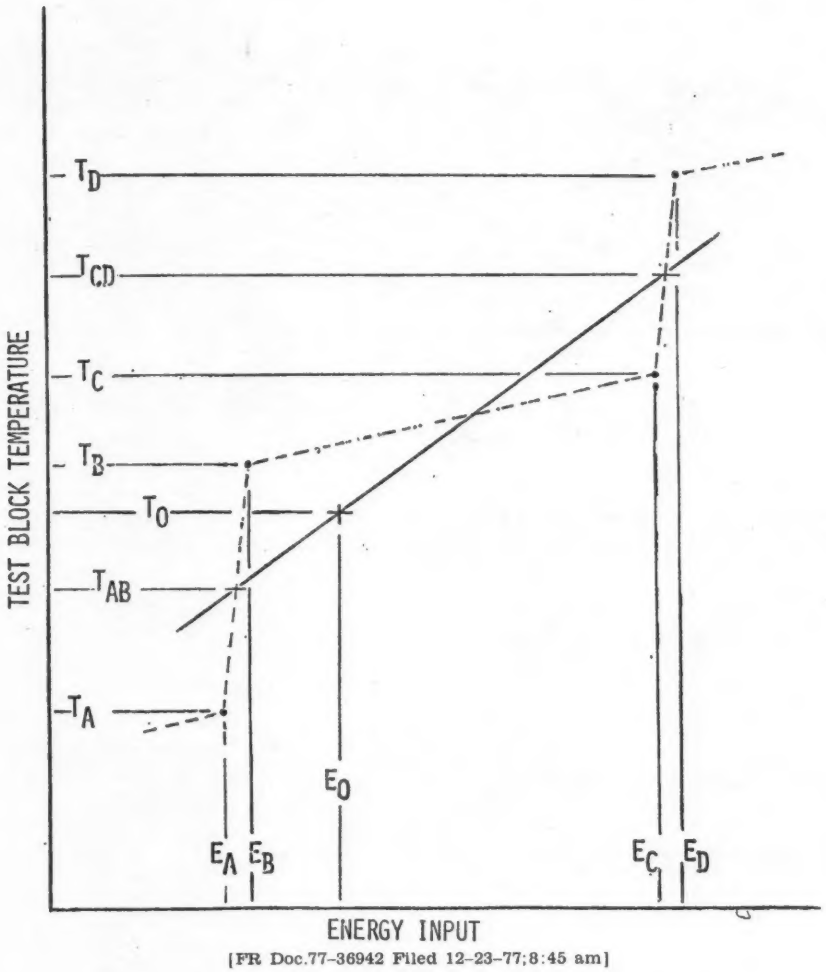
where
O_{RM}=1,109,000 Btu per year, annual useful cooking energy output.
E_{COM}=Primary energy consumption for cooking determined in 4.5.1.1.1 and expressed in Btu's/year.
E_{CAM}=Cooking top energy consumption determined in 4.5.1.2 and expressed in Btu's per year.
H_e=3412, conversion factor for kilowatt-hours to Btu's.
E_{pc}=Cooking top pilot energy consumption as determined in 4.2.2.2.2.
E_{SOM} and E_{MO}, as in 4.5.1.3.

4.5.3 *Energy factor of microwave/conventional range.* Calculate the energy factor of a microwave/conventional range, R_{RM}, and defined as:
where

$$R_{RM}=\frac{O_{RM}}{(E_{RME}\times H_e)+E_{RMG}},$$

O_{RM}=1,109,000 Btu, annual useful cooking energy output.
E_{RME}=Total annual electrical energy consumption determined from the terms given in 4.5.1.3.
E_{RMG}=Total annual gas energy consumption determined from the terms given in 4.5.1.3.
H_e=3412, conversion factor for kilowatt-hours to Btu's.

5. ILLUSTRATION OF OVEN TEST DATA



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